

# **Crash Facts Report Generator - An excel visual basic program for automating the Iowa annual crash facts report**

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## ABSTRACT

This work proposes a tool for the automatic creation of Iowa annual crash facts reports by clicking programmed buttons in two separate user interfaces designed in Excel. A dedicated Visual Basic code has been developed; to perform data retrieval from crash databases in Access, to update crash data visualizations in Excel, and to export the visualizations to a Portable Document Format (PDF) report.

**Keywords:** Iowa Crash Facts Report, Visual Basic for Application, User Interface, Excel Pivot Table, Access Database

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## INTRODUCTION

More than 38,000 people die each year in motor vehicle crashes on U.S. roadways.<sup>1</sup> The number of fatalities in Iowa is much smaller. From 2003 to 2020, an average of 374 deaths per year happened in Iowa.<sup>2</sup> That being said, the governor of Iowa thinks that one fatality is too many. “The ultimate goal is zero”.<sup>3</sup> Zero fatalities is the traffic safety goal in Iowa. This program was initiated by both the Iowa Department of Transportation (Iowa DOT) and Public Safety and Public Health. The purpose of this program is to bring attention to the behaviors of drivers contributing to fatalities in Iowa roadways.<sup>4</sup>

The annual crash facts report is one of the most important projects under the Zero Fatalities vision. It summarizes motor vehicle crashes and driver statistics on Iowa roadways, which is reported and published annually.<sup>5</sup> It seeks to help reduce the number of crashes, fatalities, and injuries. This is accomplished through collecting and studying related data on how the crashes occurred.<sup>6</sup>

Crash Facts Report Generator (CFRG) is the first tool to automate the creation of the Iowa Crash Facts Report. It allows data specialists to create and update the annual crash fact report effortlessly. The creation of CFRG aims to eliminate repetitive work and save report creation time. Before, all the annual crash facts reports were created manually. Each year, the data specialist would need to study all fifty-seven different attributes, create every single related

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<sup>1</sup> “Road Safety Facts,” *Association for Safe International Road Travel* (blog), accessed June 7, 2021, <https://www.asirt.org/safe-travel/road-safety-facts/>.

<sup>2</sup> “Iowa Vehicle Crash Fatalities Statistics | Iowa Zero Fatalities,” accessed June 7, 2021, <https://zerofatalitiesiowa.com/statistics.aspx>.

<sup>3</sup> “Iowa Traffic Fatality Reduction Task Force | Iowa Zero Fatalities,” accessed June 7, 2021, <https://zerofatalitiesiowa.com/taskforce.aspx>.

<sup>4</sup> “Zero Fatalities,” accessed June 7, 2021, <https://www.kcci.com/article/zero-fatalities-1/6895497>.

<sup>5</sup> *2016 Crash Facts* (Iowa DOT, 2021), 1, <https://iowadot.gov/mvd/stats/2016CrashFacts.pdf>.

<sup>6</sup> *Investigating Officer's Crash Reporting Guide* (Iowa Department of Transportation, 2015), iv, <https://iowadot.gov/mvd/driverslicense/InvestigatingOfficersCrashReportingGuide.pdf>.

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query in the Access database (which stores the crash data), manually link the queries with the pivot tables in Excel, manually export them as the Portable Document Format (PDF), and combine all the PDFs together. CFRG is able to replicate the standardized queries in the latest Access database, link the queries with the pivot tables in Excel sheets, update and organize all the necessary crash tables, and export them into a single PDF file. This tool saves enormous learning time and creation time. Any person can follow the instructions shown in the user interface of the Excel sheet and click the programmed buttons on the Excel sheet to generate the Iowa crash facts report of more than two hundred pages, within five minutes.

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## LITERATURE REVIEW

### Data Source and Collection

***Data collection for each crash.*** Each law enforcement agency and officer is trained to fill out the Investigating officer's report of motor vehicle accident form electronically or on paper. The officer uses the Investing Officers Crash Reporting Guide consisting of 148 pages. Every reported crash data should be properly investigated by the officer to obtain factual information.<sup>7</sup> The Iowa Crash Report Form that a police officer is given consists of a four-page blank form with a four-page code sheet, which is to instruct an officer to fill out the form correctly. The full name of the code sheet is Investigating Officer's Report of Motor Vehicle Accident Code Sheet. Iowa DOT improved and updated the code sheet in 2015.<sup>8</sup> Before the end of December 2014, the law enforcement agencies used a two-page code sheet.<sup>9</sup> Since the start of January 2015, they have been using a four-page code sheet.<sup>10</sup> Once the digital form is sent to Traffic and Criminal Software (TraCS), 'Step A' is finished for a single accident case as shown in figure 1 below.<sup>11</sup> TraCS collects data from law enforcement at the scene of a motor vehicle collision and sends that data electronically to the Iowa DOT. 95% of the crash data is collected from local and state law enforcement agencies.<sup>12</sup> The remaining five percent of the crash data is normally reported to Iowa DOT by individuals that were involved in an accident without the investigation of any law enforcement agency.<sup>13</sup>

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<sup>7</sup> *Investigating Officer's Crash Reporting Guide*, iv.

<sup>8</sup> "Official Iowa DOT: Accident Reports," accessed June 7, 2021, <https://iowadot.gov/mvd/driverslicense/accidents>.

<sup>9</sup> *Investigating Officer's Report of Motor Vehicle Accident Code Sheet* (Iowa Department of Transportation, 2001), 1-2, <https://iowadot.gov/mvd/driverslicense/CodesSheet.pdf>.

<sup>10</sup> *Investigating Officer's Report of Motor Vehicle Accident Code Sheet* (Iowa Department of Transportation, 2018), 1-4, <https://iowadot.gov/forms/433014.pdf>

<sup>11</sup> *Investigating Officer's Crash Reporting Guide*, v.

<sup>12</sup> "TraCS - Iowa Department of Transportation," accessed June 8, 2021, <https://iowadot.gov/tracs>.

<sup>13</sup> "Official Iowa DOT: Accident Reports."

## Motor vehicle crash data cycle

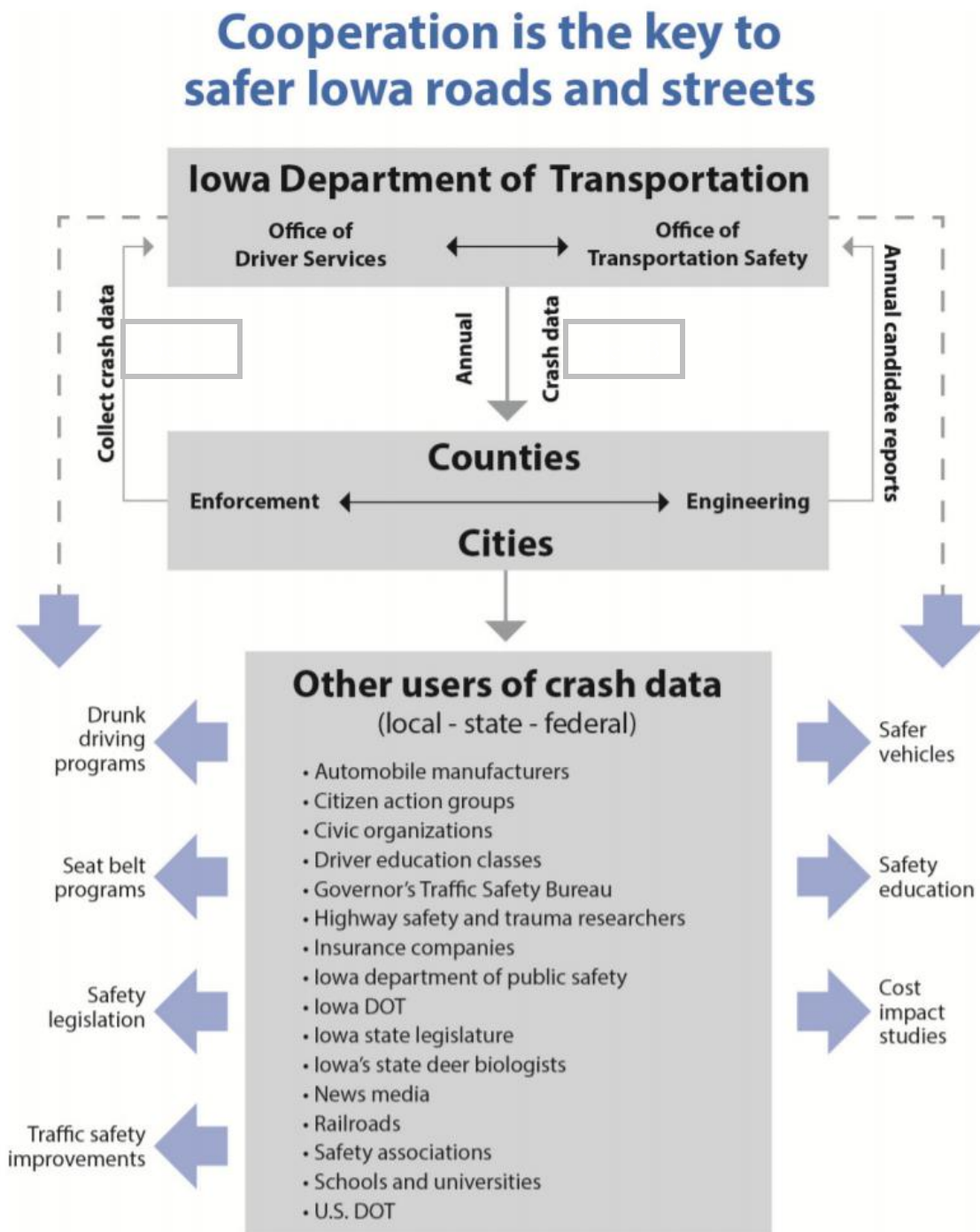


Figure 1. Motor vehicle crash data cycle in *Investigating Officer's Crash Reporting Guide*, V.

***Annual Crash Data.*** On April 15 each year, the Iowa DOT starts to finalize the annual crash data from the previous year. TraCS is used to transform the annual crash data into an Access database. The data fed to this program is updated annually, but it also can be daily with real time snapshots. The Iowa DOT updates and saves a copy of the crash data from TraCS weekly. The Iowa DOT names the copy as a snapshot. If there are any updates for the last week's crash data, they will be updated in the copy of the current week. The updates can be applied for only one case or an attribute. A 'pending' status can be withheld on a damage level attribute in a case. A person involved in an accident can be classified as a 'fatality' after being classified as a 'major injury' for 4 months. Also, the updates can be applied to fix a software error, such as the options of an attribute being incorrectly displayed.

Before exporting the annual crash data in TraCS, the Iowa DOT makes sure to exclude all Personally Identifiable Information (PII) according to OMB M-10-23 which is the Guidance for Agency Use of Third-Party Website and Applications.<sup>14</sup> Any PII that the Iowa DOT receives through either their websites or mobile applications will not be shared outside of the organization.<sup>15</sup> Once the snapshot of the Access database for the annual crash data is ready, 'Step B' is done, and the data specialist can now convert the crash data into the crash report.

## **Importance of Data**

The crash report itself and the crash data are analyzed in various areas by a variety of parties, including commercial companies, government agencies, and researchers. The crash facts

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<sup>14</sup> "Rules and Policies - Protecting PII - Privacy Act," accessed June 9, 2021, <https://www.gsa.gov/reference/gsa-privacy-program/rules-and-policies-protecting-pii-privacy-act>.

<sup>15</sup> "Privacy Policy - Iowa DOT," accessed June 9, 2021, [https://iowadot.gov/policies\\_and\\_statements/Privacy-Policy](https://iowadot.gov/policies_and_statements/Privacy-Policy).

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report gives the answers to the questions like; which are the top factors that contribute to the most crashes this year, and did the policy implemented last year work.

The earliest crash fact report reported in Iowa was in 1991.<sup>16</sup> The report has evolved during the following two decades depending on different research needs. Each crash report may be reviewed not only by lawyers, judges, and insurance companies, but also other local, state, and federal organizations. Such as, but not limited to; drunk driving programs, seat belt programs, safety legislation, traffic safety improvements, safer vehicles, safety education, and cost impact studies.<sup>17</sup>

The Office of Driver Services in the Iowa DOT utilizes the crash data to update driver records, identify unlawful drivers, and issue tickets according to the financial responsibility law in Iowa. Law enforcement agencies assign patrols to the roads where enormous speeding-related or alcohol-related crashes happen. Federal safety agencies develop safety initiatives, implement safety programs, file vehicle recalls, and contribute to making and changing laws. By comparing the specific attributes from different years, the federal agencies can tell if the law or the policy is adequate. The traffic and civil engineers of city, county, and state redesign and upgrade roads and intersections by analyzing proper crash data. Researchers study the crash data to analyze the driving behaviors by different age groups of the driving population. This analysis is used to design motor vehicles with better safety features.<sup>18</sup>

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<sup>16</sup> Iowa. Motor Vehicle Division. Office of Driver Services. *Iowa Accident Fact Book* (1991).

<sup>17</sup> *Investigating Officer's Crash Reporting Guide*, v.

<sup>18</sup> *Investigating Officer's Crash Reporting Guide*, iv.

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## Use of Excel VBA

Visual Basic for Applications (VBA) is the programming language used in this tool. The input data format in this program is Access. Ninety-nine percent of the content in each report is created in the Excel file. The final deliverable is provided as a PDF file. VBA is the programming language used in Microsoft Excel and all the other Microsoft Office programs, like Word and Access.<sup>19</sup> VBA is also compatible with PDF.<sup>20</sup>

The Iowa Annual Crash Facts Reports have been standardized by the Institute for Transportation at Iowa State University (InTrans) since 2013. Daniel Tidyman created a word file named “Crash Facts Methodology,” to guide the data specialist in the process of manually creating the Crash Facts PDF documents including; creating queries and tables in the Access databases, linking them with the pivot tables in Excel files, and creating the crash table with the pivot tables.<sup>21</sup> There is no complicated calculation needed for creating the report, excluding the need for complex languages like Python or R. The coding function can be simply turned on in any Excel file. This is because Visual Basic is embedded in the Excel software. The user interface can be designed in Excel, with visible changes when the code of any button is executed. The user can easily tell how far along the progress is. It is much easier than incorporating other languages and applications to replicate the previous data visualizations. Therefore, using Visual Basic was the best choice in this project.

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<sup>19</sup> “Excel VBA - What Is VBA in Excel? Definition and Overview,” Corporate Finance Institute, accessed June 9, 2021, <https://corporatefinanceinstitute.com/resources/excel/study/excel-vba/>.

<sup>20</sup> “Save Excel as PDF with VBA - Excel Off The Grid,” accessed June 9, 2021, <https://exceloffthegrid.com/vba-code-save-excel-file-as-pdf/>.

<sup>21</sup> Daniel Tidyman, “Crash Facts Methodology.” (Instruction Manual, private collection of InTrans, 2018), 4

## METHODOLOGY

The main source material used in the creation of the Crash Facts Report Generator (CFRG) was the “Crash Facts Methodology.” This document was out-of-date and in need of improvement. The adaptation for the CFRG began with defining errors or lack of specification. After the issues were identified I began forming a new method. The final step was a comparison between the old method defined in the “Crash Facts Methodology” and the new method used in the CFRG. The whole project was supervised by Dr. Naraghi Hossein, a research engineer in InTrans.

### **Inaccuracy and Faults within previous documents/ methodology**

*Data and Queries in Access.* The annual Crash Data is exported from TraCS in Access. The data can be merged into one-year or five-year periods (figure 2). The Iowa DOT can also merge a five-year period of crash data together when a five-year period or two five-year periods of crash data are ready. The data format of the annual crash data is always in an Access Database.

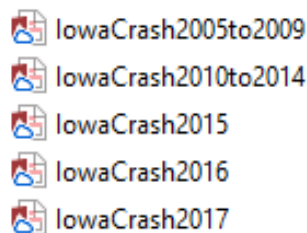


Figure 2. Access Databases provided by Iowa DOT.

Each Access Database has fourteen tables originally (figure 3). CRASH\_LEVEL, PERSON\_LEVEL, and VEHICLE\_LEVEL are the three main tables used in this project, highlighted in figure 3 below. Before the end of 2014, CRASH\_LEVEL had eighty-seven attributes, PERSON\_LEVEL had twenty-five attributes, and VEHICLE\_LEVEL had fifty-five

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attributes. Since the start of 2015, CRASH\_LEVEL has seventy-seven attributes, PERSON\_LEVEL has twenty-eight attributes, and VEHICLE\_LEVEL has seventy-one attributes.

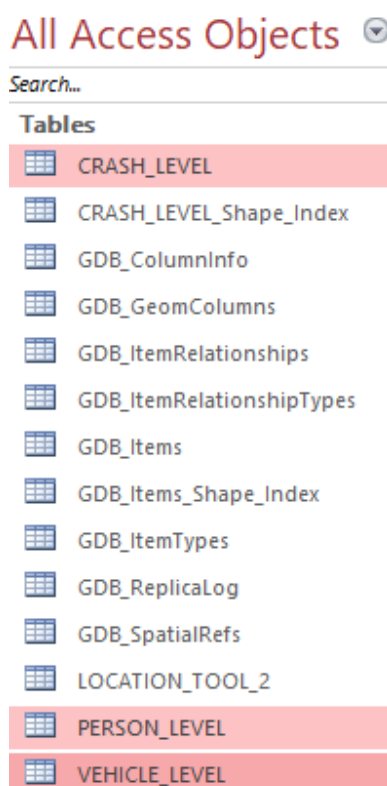


Figure 3. All Access Objects in an original crash data Access Database.

The differences in the number of attributes in these three tables is caused by the code sheet change in 2015. The number of queries that are needed to be created in Access does not change. However, the criteria to create the queries is changed. The new code sheet added more options under certain attributes. For example, VCONFIG which is the column name for a vehicle configuration. The old code sheet only has twenty-four options (figure 4), compared to thirty-eight options in the new code sheet (figure 5).

Vehicle Configuration	
01 - Passenger car	
02 - Four-tire light truck (pick-up, panel)	
03 - Van or mini-van	
04 - Sport utility vehicle	
05 - Single-unit truck (2-axle, 6-tire)	
06 - Single-unit truck ( $\geq 3$ axles)	
07 - Truck/trailer	
08 - Truck tractor (bobtail)	
09 - Tractor/semi-trailer	
10 - Tractor/doubles	
11 - Tractor/triples	
12 - Other heavy truck (cannot classify)	
13 - Motor home/recreational vehicle	
14 - Motorcycle	
15 - Moped/All-Terrain Vehicle	
16 - School bus (seats $> 15$ )	
17 - Small school bus (seats 9 - 15)	
18 - Other bus (seats $> 15$ )	
19 - Other small bus (seats 9 - 15)	
20 - Farm vehicle/equipment	
21 - Maintenance/construction vehicle	
22 - Train	
88 - Other (explain in narrative)	
99 - Unknown	

Figure 4. Vehicle Configuration in the old code sheet (*Investigating Officer's Report of Motor Vehicle Accident Code Sheet*, 2001), 1.

Vehicle Configuration	
1 - Passenger car	21 - Motor home/recreational vehicle
2 - Four-tire truck (pick-up)	
3 - Sport utility vehicle	22 - School bus (seats $>15$ )
4 - Passenger van (seats $<9$ )	23 - Small school bus (seats 9-15)
5 - Passenger van (seats 9-15)	24 - Other bus (seats $>15$ )
	25 - Other small bus (seats 9-15)
6 - Cargo/panel van	
7 - Single-unit truck (2-axle, 6-tire)	26 - Farm tractor
8 - Single-unit truck ( $\geq 3$ axles)	27 - Farm equipment
9 - Other light truck ( $\leq 10,000$ lbs)	(explain in narrative)
10 - Vehicle $\leq 10,000$ lbs, placarded for hazardous materials	28 - All-terrain vehicle (ATV)
11 - Truck/trailer	29 - Snowmobile
12 - Truck tractor (bobtail)	30 - Golf cart
13 - Tractor/semi-trailer	31 - Street legal, low-speed vehicle
14 - Tractor/doubles	32 - Limousine/taxi (seats 8 or less)
15 - Tractor/triples	33 - Limousine/taxi (seats 9-15)
16 - Other heavy truck ( $>10,000$ lbs) (cannot classify)	34 - Limousine/taxi (seats $>15$ )
	35 - Maintenance/construction vehicle
17 - Motorcycle	36 - Train
18 - 3-wheeled, enclosed	
19 - 3-wheeled, unenclosed	98 - Other (explain in narrative)
20 - Moped	99 - Unknown

Figure 5. Vehicle Configuration in the new code sheet (*Investigating Officer's Report of Motor Vehicle Accident Code Sheet*, 2018), 1.

The detailed steps to create each query are explained in the “Crash Facts Methodology.” Queries created in Access are used to pull data into pivot tables in Excel. The “Crash Facts Methodology” defines a query as “a basic collection of information pulled from a database that matches certain conditions such as size, year, or certain values”.<sup>22</sup> For example, the “Use Motorcycle” query is used to create the query displayed in figure 6.

### Motorcycle Crash Severity

- a. Create a new query, selecting Motorcycle Crash Keys and CRASH\_LEVEL (Before 2015), selecting VEHICLE and CRASH\_LEVEL (2015 and after 2015).
- b. Join them both together based off CRASH\_KEY
- a. Select CRASH\_KEY, CSEVERITY, YEAR\_, FATALITIES, MAJININJURY, MININJURY, POSSINJURY, UNKINJURY, PROPDMG from CRASH\_LEVEL and VCONFIG from VEHICLE\_LEVEL.
- b. Criteria: 2004-2014: VCONFIG = “14”  
After 2015: VCONFIG = “>16 And <20”
- c. Save as Motorcycle Query.

Figure 6. Motorcycle Query instruction (*Crash Facts Methodology*), 16.

As shown in figure 6, instruction in the “Crash Facts Methodology” was not complete. The red font is my contribution after my research of all previous Motorcycle Queries and two versions of the state mandated code sheet. The correct query was built to pull the correct crash data, this is shown in figures 7 and figure 8.

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<sup>22</sup> Daniel Tidyman, “Crash Facts Methodology.”, 5.

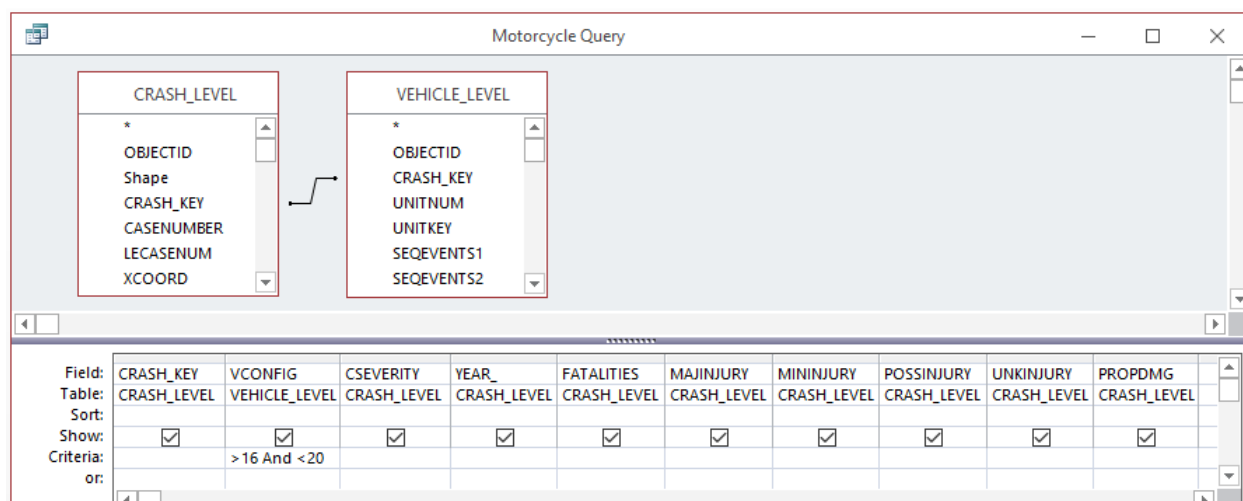


Figure 7. Design view of Motorcycle Query in Access for 2016 Crash Data.

CRASH_KEY	VCONFIG	CSEVERITY	CRASH_YEAR	FATALITIES	MAJINJURY	MININJURY	POSSINJURY	UNKINJURY	PROPDGMG
20160909927	17	3	2016	0	0	1	0	0	700
20160909965	17	3	2016	0	0	1	0	0	1500
20160910018	17	3	2016	0	0	1	0	0	5000
20160910035	17	5	2016	0	0	0	0	0	3400
20160910163	17	5	2016	0	0	0	0	0	3200
20160910581	17	4	2016	0	0	0	1	0	2000
20160910681	17	2	2016	0	1	0	0	0	8000
20160910681	17	2	2016	0	1	0	0	0	8000
20160910861	17	4	2016	0	0	0	0	1	1800
20160910912	17	5	2016	0	0	0	0	0	2500
20160911101	17	4	2016	0	0	0	1	0	1500

Figure 8. Table view of Motorcycle Query in Access for 2016 Crash Data.

Due to the inconsistency and inaccuracy that exists in the “Crash Facts Methodology”, I reviewed and corrected all the queries in the Access databases. I corrected the queries that used the wrong criteria, the queries that linked with the wrong table, and the queries that selected the wrong attributes. The reviewed and corrected databases include “IowaCrash2010to2014” and “IowaCrash2016” in figure 2. The reason for using these two specific databases is to ensure the validity of the queries of the old and new coding systems. For example, all the queries created in “IowaCrash2010to2014” can be copied and pasted into any Access database dated before the end of 2014. As well as “IowaCrash2016” queries being copied and pasted into the Access database since the start of 2015. The action of copy and paste can be performed via VBA.

***Pivot Tables and Crash Tables in Excel.*** After organizing the queries in both Access Databases, pivot tables and crash tables can be created inside Excel files. The instructions for creating pivot tables and crash tables are available in the “Crash Facts Methodology.” Using Motorcycle Crash Severity as an example, a step-by-step instruction is shown in figure 9.

## Creating the Pivot Table

### Motorcycle Crash Severity

- a. Insert the Motorcycle Query as a Pivot Table and place CSEVERITY in Rows, YEAR\_ in Columns, and Count of CRASH\_KEY in Values.
- b. Set up the Pivot Table for each year.
- c. Set up your GETPIVOTDATA function to pull from each table based on year like we have been doing.
- d. For the Injuries Side, replace “Count of CRASH\_KEY” with the “Sum of FATALITIES”, “Sum of MAJINJURY”, etc and modify the GETPIVOTDATA function like we have for the Injuries portion of the sheets.
- e. Make sure our SUM functions are working and save.

Figure 9. The instructions to create a Motorcycle pivot table and crash table in Excel (*Crash Facts Methodology*), 16.

The instructions for creating crash tables are not clear, as seen in figure 9. To correct for this, I created templates for the creation of the pivot tables and crash tables in Excel for both 2014 and 2016. These templates pull data from the correct coding system. The templates that corrected the errors include; pivot tables connected to the wrong query, pivot tables that used the wrong attribute to populate rows or columns, and crash tables that populate the crash data from the wrong year.

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## Improvements

After analyzing the “Crash Fact Methodology,” I understood how to create each crash table, how to export Excel files into PDFs, and how to combine all the PDFs together. I was also aware of what materials were used to create the old Iowa Crash Report. That being the multitude of excel files and PDF documents. The resulting discoveries can be implemented to increase the speed of creating the Crash Facts Report in CFRG.

During the Excel templates creation, I discovered why the size of the previous Excel files are gigantic (table 1).

Table 1. Crash Report Layout differences between the “Crash Facts Methodology” and the method used

Report Generation Differences between the old method and the new method					
File	Excel Name and File Size			PDF Name	
Section Name	Crash Facts Methodology		This paper	Crash Facts Methodology	This paper
Cover Page	NA		NA	Table of Contents	Cover
				Title Page for Crash Facts	
Fatalities and Crash Trend	Crash Trends	458,002 KB	CrashFactsReport_VBA - 2017	854 KB	2006-2015 Crash Trends
	Fatalities by County	113,935 KB			2006-2015 Fatalities by County
Crash Detail	Crashes by Age	6,683 KB			Crashes by Age
	Crashes by County	219,847 KB			Crashes by County
	Crashes by Day	217,505 KB			Crashes by Day
	Crashes By Month	175,135 KB			Crashes By Month
	Crashes by Num Veh	229,031 KB			Crashes by Num Veh
	Crashes by OccuProt	18,466 KB	CF_2017_VBA	350 KB	Crashes by OccuProt
	Crashes by Truck, Bus, Train	1,651 KB			Crashes by Truck, Bus, Train
	Crashes Invol Alc & Drug	230,498 KB			Crashes byTime of Day
	Crashes with Motorcycles	389 KB			Crashes Invol Alc & Drug
	Crashes with NM	5,542 KB			Crashes with Motorcycles
	CrashesbyTime of Day	227,979 KB			Crashes with NM
		Each Year		Each Year	Crashes Year Page for Crash Facts

First, the Excel files created when following the previous instructions list all the pivot tables from 2004 up-to the latest available year (figure 10).

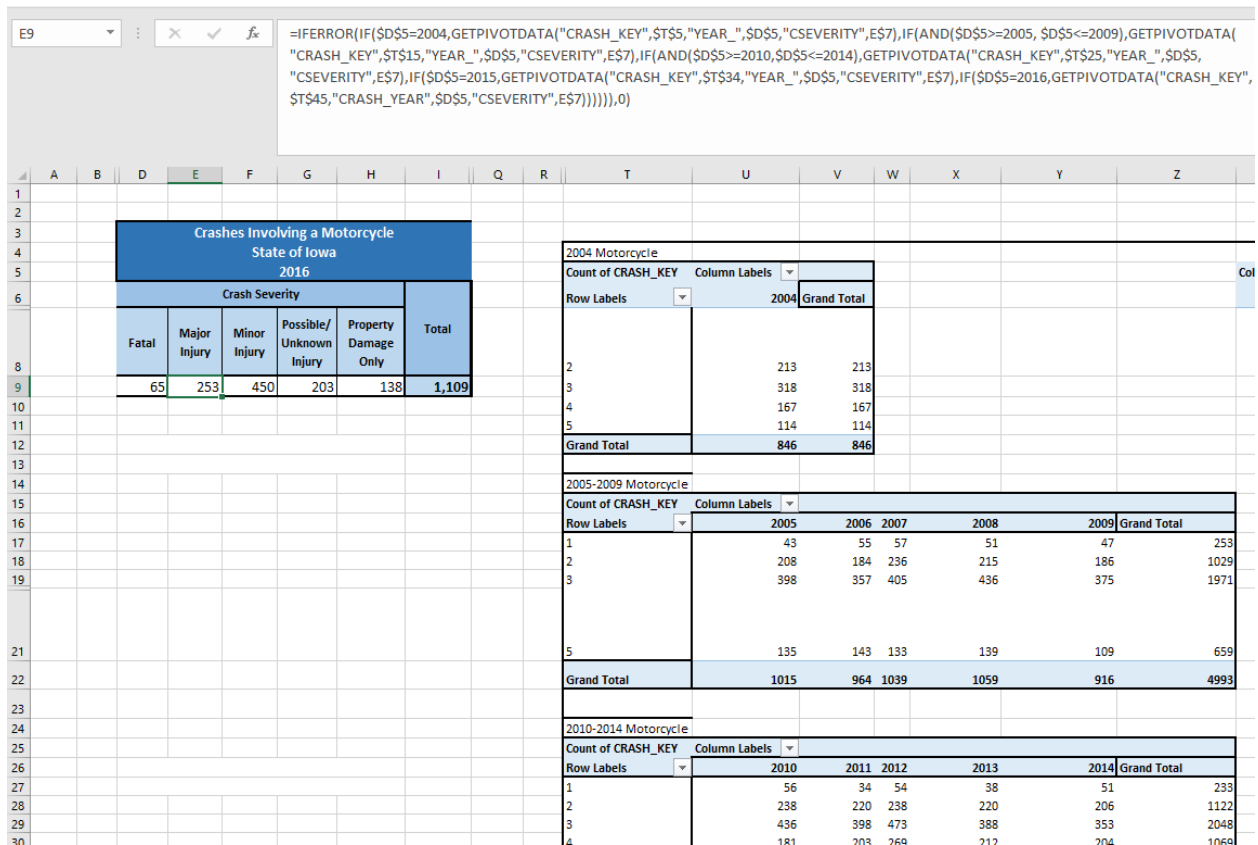


Figure 10. A screenshot of the Motorcycle table and pivot tables created by the old method.

Second, all the source data is saved with the Excel file (figure 11). “Save source data with file” is checked for every single pivot table created before.

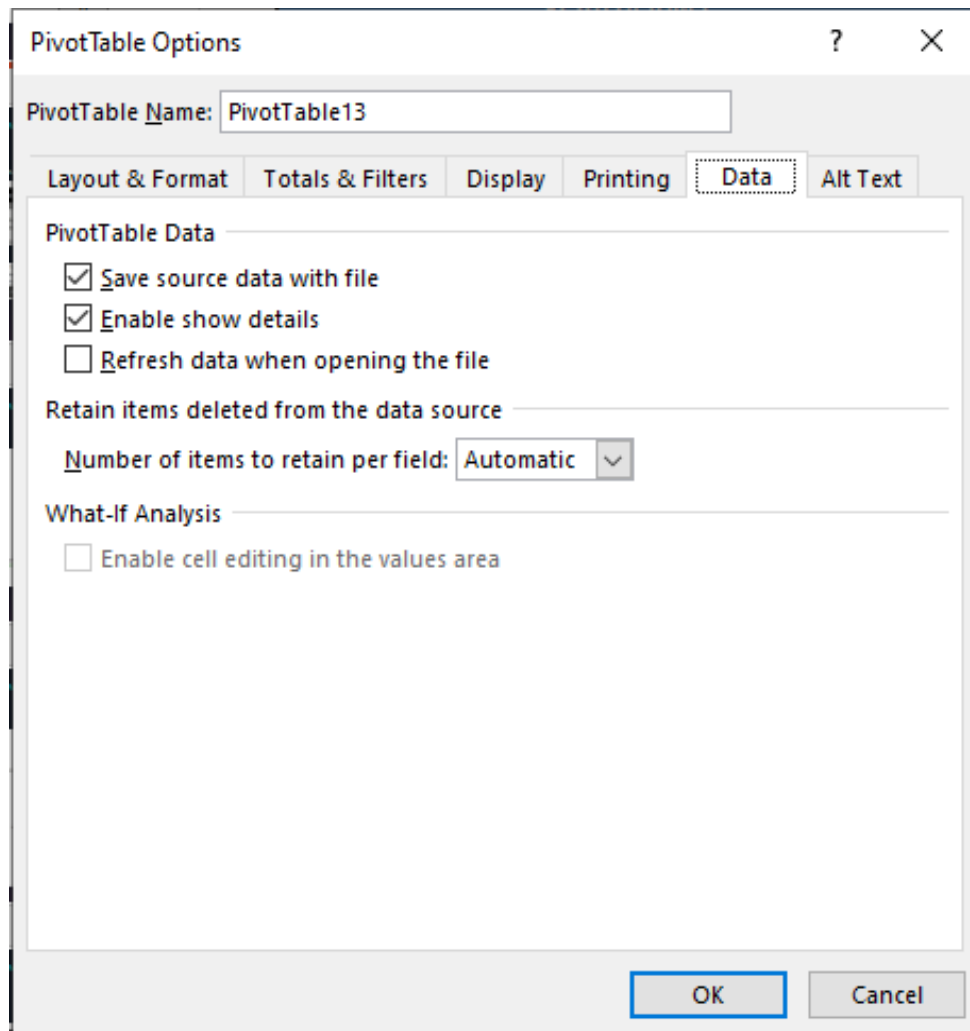


Figure 11. The Data tab under PivotTable Options in the old method.

As an example of cutting out the unneeded data, I used the existing Excel file called “Crashes with Motorcycles” in figure 10, to replicate the motorcycle crash table for 2016. That table is seen in figure 12. I removed all the pivot tables that are not for the year 2016. The only pivot table left is set to not save the source data. The Excel function has been reduced to only include the function for 2016. This process is repeated to cut out the unneeded data for each crash table that needs to be presented in the report.

C7			=IFERROR(GETPIVOTDATA("CRASH_KEY",SQ\$6,"CSEVERITY",S\$4,"CRASH_YEAR",SB\$4),0)												
	A	B	C	D	E	F	G	O	P	Q	R	S	T	U	V
1															
2		Crashes Involving a Motorcycle													
3		State of Iowa													
4		2016													
5		Crash Severity					Total Crashes								
		Fatal	Major Injury	Minor Injury	Possible/Unknown Injury	Property Damage Only									
6															
7		65	253	450	203	138	1,109								
8															

Motorcycle Query													
Crash Severity													
Count of CRASH_KEY													
Column Labels													
Row Labels													
2016													
Grand Total													

Figure 12. Motorcycle Crash Table and Pivot Table in 2016

Another one of my discoveries was that all the tables could be grouped into two Excel files. This made it easier to write the VBA program. I regrouped the Excel files and PDF files created, as shown in table 1. The program only creates two Excel files and two PDFs each year (table 1). According to the “Crash Facts Methodology,” the data specialist needs to create twelve Excels and twelve PDFs each year. My method creates fewer Excel files and PDF files, both of which are a much smaller size. The rearrangement of Excel and PDF files decreased the number of templates needed from thirteen to two.

## Components of the report: Comparison between old method and the new method

I have broken down the report into three components that follow a logical pattern. The logical pattern provides a friendlier environment for the VBA coding. The three parts are the cover pages, fatalities and crash trend, and the detailed crash tables for each year. The differences between the old method and the new methods are performed in each part.

Table 2. Crash Report Generation differences between the “Crash Facts Methodology” and the method I used.

Report Generation Differences between the old method and the new method					
Section Name	Excel Name and File Size		PDF Name		
	Crash Facts Methodology		Crash Facts Methodology		This paper
<b>Cover Page</b>	NA		Table of Contents Title Page for Crash Facts		Cover
<b>Fatalities and Crash Trend</b>	Crash Trends 458,002 KB Fatalities by County 113,935 KB	CrashFactsReport_VBA - 2017 854 KB	2006-2015 Crash Trends 2006-2015 Fatalities by County		Fatal&CrashTrend_2017
<b>Crash Detail</b>	Crashes by Age 6,683 KB Crashes by County 219,847 KB Crashes by Day 217,505 KB Crashes By Month 175,135 KB Crashes by Num Veh 229,031 KB Crashes by OccuProt 18,466 KB Crashes by Truck, Bus, Train 1,651 KB Crashes Invol Alc & Drug 230,498 KB Crashes with Motorcycles 389 KB Crashes with NM 5,542 KB CrashesbyTime of Day 227,979 KB	CF_2017_VBA 350 KB	Crashes by Age Crashes by County Crashes by Day Crashes By Month Crashes by Num Veh Crashes by OccuProt Crashes by Truck, Bus, Train Crashes byTime of Day Crashes Invol Alc & Drug Crashes with Motorcycles Crashes with NM Crashes Year Page for Crash Facts		2017
	Each Year		Each Year		Each Year

**Cover Pages.** The cover of the entire report (figure 13) and a table of content (figure 14) are included in this section. The crash scene photo in figure 13 is different each year. It is selected and updated by the Iowa DOT. There is no content in this section that is related to the crash data Access Database, except for the year information. The year information and page numbers on both pages can be manually updated after all the PDFs are exported. There is no need to create two separate files as listed in table 2. I combined the Table of Contents and Title Page for Crash Facts into a single PDF called Cover.



Figure 13. Cover or first page  
(2016 Crash Facts).

Iowa Crash Facts 2007-2016	
Table of Contents.....	i
Fatalities by County.....	1
Crash Trends.....	4
2007.....	13
2008.....	34
2009.....	55
2010.....	76
2011.....	97
2012.....	118
2013.....	139
2014.....	160
2015.....	181
2016.....	202

Disclaimer  
Crash snapshot date for pre-2015: 1/15/2016  
Crash snapshot date for 2015: 8/22/2016  
Crash snapshot date for 2016: 2/1/2016  
Fatality totals may differ from FARS.

Figure 14. Table of contents  
(2016 Crash Facts).

***Fatalities and Crash Trend.*** This section includes a “fatalities by county” table, a cover page of Crash Trend, and ten crash trend tables. Fatalities and Crash Trend tables describe the fatalities trend and crash trends in the past ten years. An example can be viewed in figure 15. The table titles for these ten crash trend tables as ordered in the report are; Crash History, Crashes Involving Non-Motorist, Crashes Involving Drugs or Alcohol, Crashes by Number of Vehicles - Single Vehicle, Crashes by Number of Vehicles - Multiple Vehicles, Crashes Involving Motorcycles, Crashes Involving Heavy Trucks - Single Unit Truck, Crashes Involving Heavy

Trucks - Other Heavy Truck, Crashes Involving Buses - School Bus, Crashes Involving Buses - Other Bus, Crashes Involving trains.<sup>23</sup>

The cover page of Crash Trend does not change in the crash facts report from year to year. However, the other eleven tables in this section need to remove the oldest years' data and add the newest years' data when creating the crash facts report for the newest year (figure 15). This is the general process or rule to create a new Crash Facts Report. The 2016 Crash Facts Report contains all the crash tables from 2007 to 2016. The 2017 Crash Facts Report contains the past 9 years of crash tables from 2008 to 2016 and the new tables from the 2017 crash data.

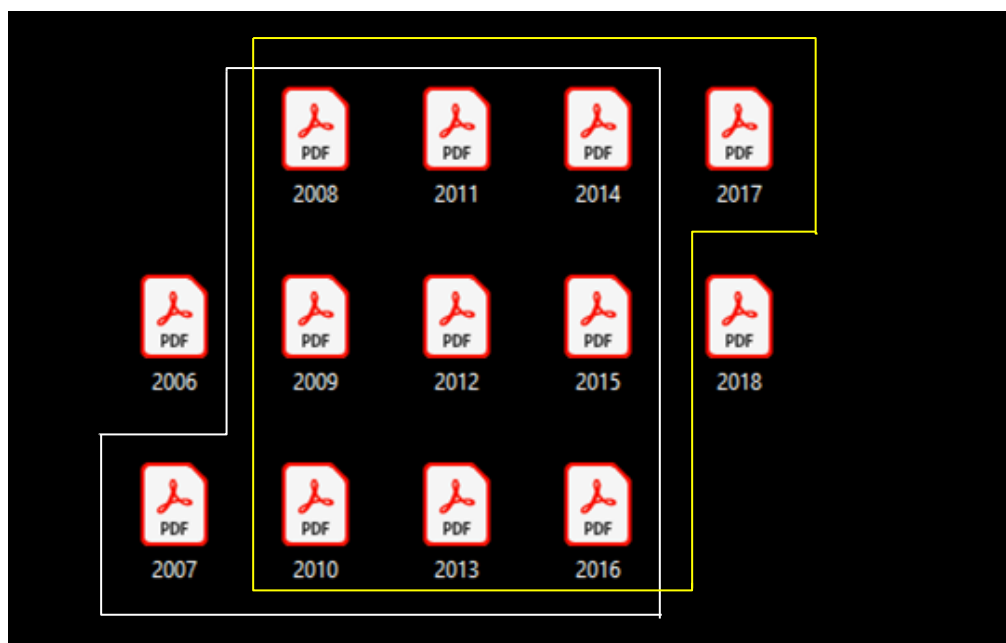


Figure 15. General process of creating a Crash Facts Report.

All eleven tables in this section need to be updated with ten years of crash data. Using the Crash History table as an example, shown in figure 16 below. When creating the 2016 Crash Facts Report, the Crash History table should present crash data from 2007 to 2016. When

<sup>23</sup> 2016 Crash Facts, 5-12.

creating the 2017 Crash Facts Report, the table should present the data from 2008 to 2017. It is the same as the rest of the fatalities, and crash trend tables.

Crash History State of Iowa													
Year	Crash Severity					Total	Injury Severity					Total Injuries	Estimated Property Damage (in thousands)
	Fatal	Major Injury	Minor Injury	Possible/Unknown Injury	Property Damage Only		Fatal	Major	Minor	Possible	Unknown		
2007	393	1,608	5,424	9,530	41,854	58,809	446	1,980	7,293	12,137	1,499	23,355	\$ 279,714
2008	367	1,465	5,411	9,092	43,583	59,918	411	1,841	7,310	11,879	962	22,403	\$ 296,817
2009	338	1,301	4,737	8,396	40,722	55,494	371	1,616	6,307	11,029	917	20,240	\$ 275,733
2010	348	1,345	4,843	8,392	39,468	54,396	390	1,647	6,362	10,901	1,019	20,319	\$ 283,740
2011	329	1,247	4,474	7,775	34,968	48,793	360	1,510	5,970	10,099	836	18,775	\$ 270,505
2012	330	1,334	4,529	7,547	34,142	47,882	365	1,637	6,078	10,042	693	18,815	\$ 282,705
2013	290	1,252	4,517	7,375	36,575	50,009	317	1,549	5,874	9,727	617	18,084	\$ 301,328
2014	287	1,234	4,518	7,842	38,132	52,013	321	1,515	5,960	10,009	773	18,578	\$ 317,369
2015	282	1,225	4,835	9,223	39,024	54,589	320	1,467	6,305	11,331	1,338	20,761	\$ 340,482
2016	355	1,237	5,047	9,416	39,793	55,848	402	1,510	6,457	11,299	1,589	21,257	\$ 354,090
Total	3,319	13,248	48,335	84,588	388,261	537,751	3,703	16,272	63,916	108,453	10,243	202,587	\$ 3,002,481

Figure 16. Crash History table (2016 Crash Facts), 5.

As displayed in Table 2, the old method combined all 10 crash trend tables into a Crash Trend PDF file and a fatalities table into a Fatalities by Country PDF. Instead of creating two separate Excel or PDF files, all the eleven crash tables in this section can be combined into a single Excel or PDF file.

**Crash Detail.** This section incorporates a cover for each year and twenty-one detailed crash tables for each year. The table titles and table content are the same for each year. The names of the crash detail tables as ordered in the report are; Crashes by County, Crashes by Month, Crashes by Day of week, Crashes by Time of Day, Drivers by Age, Injuries by Age, Non-Motorist Type, Injuries of Non-Motorists, Crashes Involving Drugs or Alcohol, Drivers by Age (Alcohol-related), Drivers by Gender (Alcohol-related), Drivers by Age (Drug-related), Drivers by Gender (Drug-related), Occupant's Injuries, Crashes by Number of Vehicles, Crashes Involving a Motorcycle, Motorcyclist Injuries, Crashes involving Heavy Trucks, Number of Trucks involved in Crashes, Crashes Involving Buses, Number of Buses Involved in Crashes,



and Crashes Involving Trains.<sup>24</sup> All these twenty-one detailed crash tables are presented for only one year. In total, this section has 210 tables for all ten years.

The general rule of creating a crash facts report is applied here as well (figure 15). When creating the 2016 Crash Facts Report, the crash data from 2007 to 2016 are presented in the Crash Detail section. When creating the 2017 Crash Facts Report, the crash detail tables in 2007 are removed and the new crash detail tables in 2017 should be added.

As shown in Table 2, the old method organized these twenty-one crash tables into eleven Excels and PDFs, as well as a single PDF cover page for each year. I combined all twelve files into a single file. All the table layouts, queries, and cover pages formats are the same for each year. The only thing that needs to be updated is the year information.

Following this methodology, leads to these results and further analysis.

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<sup>24</sup> 2016 *Crash Facts*, 16-35

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## ANALYSIS AND RESULTS

Only two Excel files need to be created for replicating Crash Facts Report each year, CF\_20XX\_VBA and CrashFactsReport\_VBA - 20XX. These Excel files are created to populate the crash tables for the Fatalities and Crash Trend and the Crash Detail section, respectively. The process of creating the user interface and the logic behind each button is explained in this section. The VBA code designed for each button can be found in Appendices.

### Crash Detail Template

First, I created an Excel template for creating crash detail tables. I will use the 2017 crash data as an example. The Excel file contains a user interface, a cover sheet for that year, and twenty-one separate crash detail tables for that year. A screenshot of all the sheet tabs is attached below in figure 17.



Figure 17. Sheet Tabs of the CF\_2017\_VBA Excel file.

The VBA sheet contains a user interface called CrashFacts - 2017 Part - PDF Generation Tool (figure 18). This user interface is designed for guiding the user in creating a cover page, twenty-one separate crash detail tables, and a seventeen-page PDF. Each tab generates only a one-page PDF, with one or two tables.

A		B	C
1		<b>CrashFacts - 2017 Part - PDF Generation Tool</b>	
2			
3		<b>Given: Description</b>	
4		Year of This CrashFacts File:	2017
5		Old Access Database File Path:	C:\Users\Old2017.mdb
6		Current Access Database File Path:	C:\Users\New2017.mdb
7		Current Access Database File Name:	New2017.mdb
8		2017 CrashFacts PDF File Path:	C:\Users\2017.pdf
9		<b>Action 1: Update new 2017 Access database file path</b> To Do: Click the button below, Select the new Access file in the pop-up window After Action 1: The Access file you just selected will be updated in two cells, C6 and C7. The previous Access file path will be shown in cell C5, as the old Access Database File Path.	
10		<b>Action 1: Update 2017 Access Database</b>	
11			
12		<b>Pre-request:</b> Cells C5 and C6 are correctly filled. <b>Action 2:</b> Copy all the queries created in the old Access database file into the current Access database file To Do: Click the button below, Wait for the message "Done!" After Action 2: All the queries are pasted into the current Access database.	
13		<b>Action 2: Copy All Queries</b>	
14			
15		<b>Action 3:</b> Update all the Pivot Tables' source to Current Access Database File Path To Do: Click the button below, Wait for the message "Done!" After Action 3: All the Pivot tables now link to the current database in Cell C6.	
16		<b>Action 3: Update All Tables</b>	
17			
18		<b>Pre-request:</b> Manually check every sheet first <b>Action 4:</b> Create 2017 CrashFacts pdf from Sheet Cover to Sheet 26 To Do: Click the button below, Wait for the message After Action 4: The 2017.pdf file will be created in the same folder where CF_2017_VBA file is. file Path will be updated in Cell C8.	
19		<b>Action 4: Create 2017.pdf</b>	
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32		*To stop running code, press Ctrl + Break	

Figure 18. User interface in Sheet VBA in CF\_2017\_VBA.

The Sheet Cover shows the year of the crash data used in all crash detail tables (figure 19).



Figure 19. Sheet Cover in CF\_2017\_VBA.

In total, sixteen sheets are used in the Excel file to populate all crash detail tables with 2017 crash data. The sheets are numbered “11” to “26”. The layout of each table is the same as the motorcycle table in figure 10. Each crash table links with the correct pivot tables. Each pivot table connects with the correct query from 2017 crash Access Database. All the code written in this file can be applied to any year. This Excel template can be used to create all Crash Detail tables for any year.

Any person can follow the instructions and click the four buttons in the VBA sheet to create a PDF file of any of the crash detail tables. All four buttons are labeled “Action 1” to “Action 4”.

**Action 1.** The first action is to update the crash Access database used in this Excel file. When the user clicks the Action 1 button, the pop-up window shows up for choosing the new Access Source File for 2017 (figure 20). If no file is selected and the user clicks Open, the program exits without doing anything. It is only if a valid file is selected, that the file path of the selected file will be updated in Cell C6 and Cell C7, seen in figure 18. Cell C6 displays the file path of the file selected. Cell C7 displays the name of the file selected. Because the file path of the selected file can be too long, it is easier for the user to verify if the correct file has been selected. As opposed to finding the file name at the end of the file path in Cell C6.

The user can change the year in Cell C4 to start creating crash detail tables for a new year. The year information on each page is set to be equal to Cell C4. CF\_2017\_VBA can be copied and pasted to create CF\_2018\_VBA file. All that would need to be done is to change Cell C4 from 2017 to 2018 and follow the actions from Action 1 to Action 4. The VBA code written for Action 1 is attached in Appendix A Code A1.

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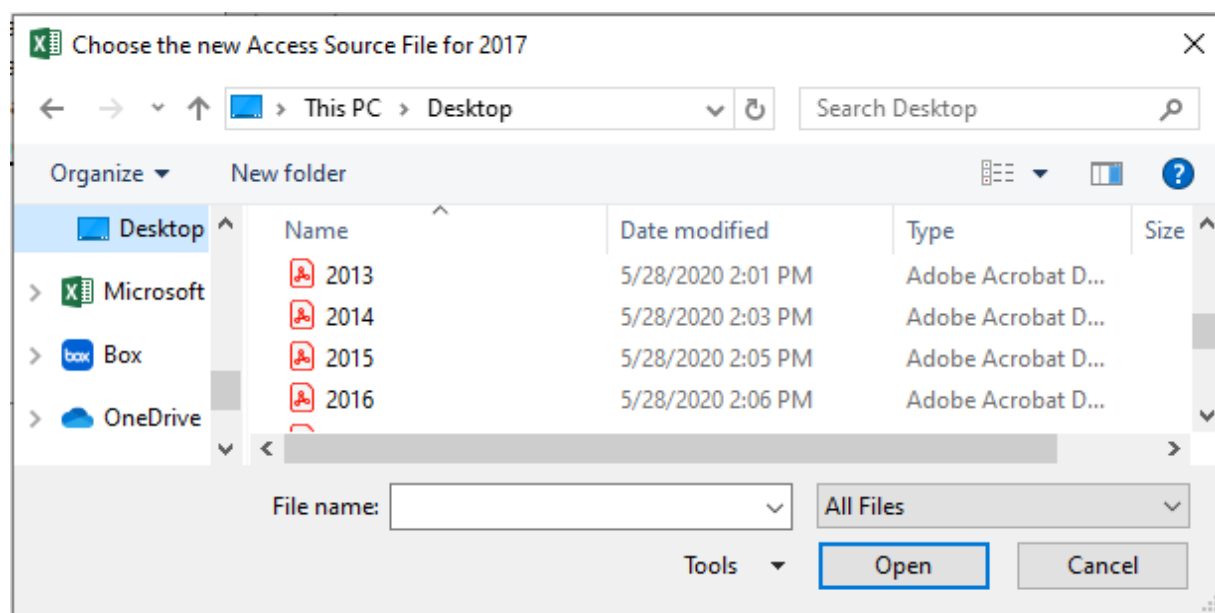


Figure 20. Action 1 Pop-up Window.

**Action 2.** The second action is to copy all the queries created in the old Access database file and paste them into the current Access Database file. The Access Database must be a new database that is freshly exported from TraCS without any queries created. If any of the old or new Access file paths are blank, an error message will show and the program will stop (figure 21).

The essential logic used in this program is the for loop. The program scans all the queries created in the old Access file then copies and pastes them into the new Access file. The VBA code of Action 2 is attached in Appendix A Code A2.

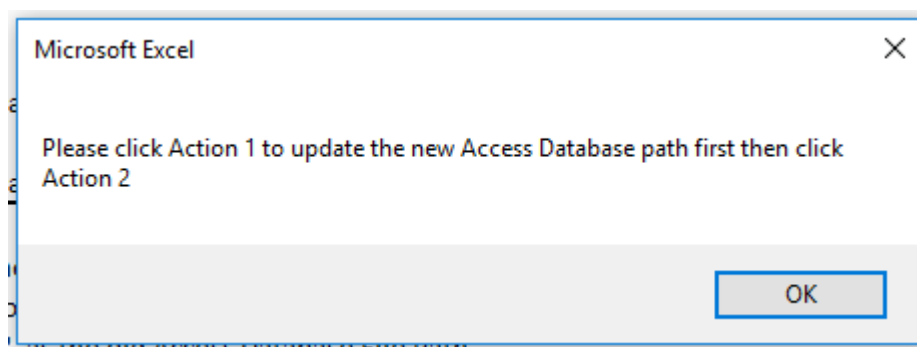


Figure 21. Action 2 error message

**Action 3.** The third action is to update all the connection queries of pivot tables. This can be done by using the queries created in Action 2 of the new or current Access Database File. When the process is done a message of “Done!” will be displayed (figure 22). The whole process takes about 40 seconds to update all 42 pivot tables. All the crash detail tables in each sheet are updated automatically because of the automated Excel function written for each cell in the crash table. This is the action that takes the longest time to run. I implemented code to increase the efficiency of this action. The efficiency code runs while the action runs and turns off screen updating, the display status bar, the event display, and page break display.

The for loop is used in this action as well. The code loops through all the pivot tables in the Excel file to update the connection file. There are different error messages that can pop up during the coding process to alert the specialist. I added an error message display section to contain these messages. If any error occurs, the error message window displays the pivot table name, sheet name, and error description for each error (figure 23). I created a 10-page document explaining how to correct for the different error messages that can be encountered. As an example, the solution to solve the error message in figure 23 is to move the year attribute to the rows field out of the columns field in PivotTable12.<sup>25</sup> The VBA code of Action 3 is attached in Appendix A Code A3.

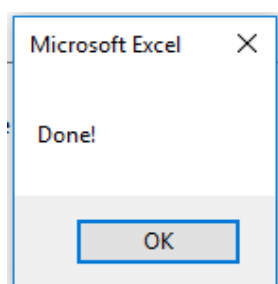


Figure 22. Action 3 complete message.

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<sup>25</sup> Yue He, “Excel Tool Error and Solution.” (Instruction Manual, private collection of InTrans, 2021), 5

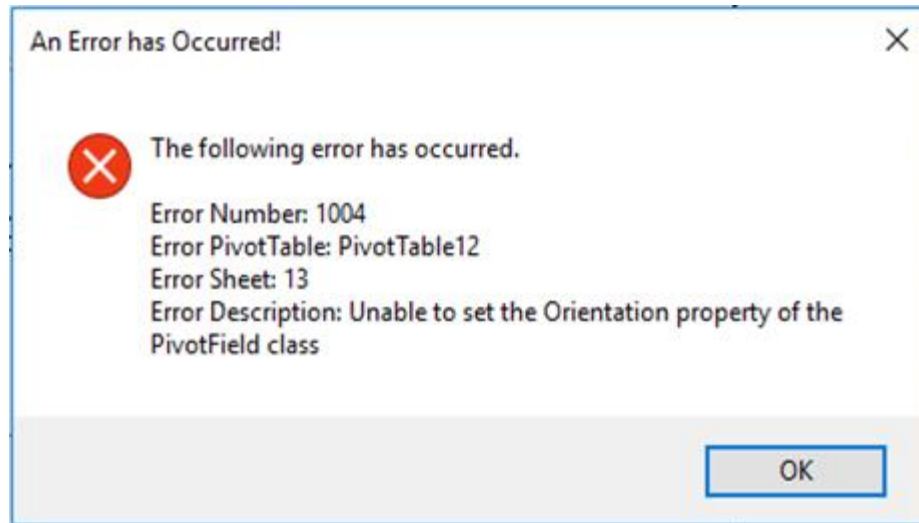


Figure 23. An error message example

**Action 4:** The fourth Action is to export the content from the sheets Cover through 26 into a single PDF file. The data specialist needs to select each sheet first before clicking the button. The year should be confirmed as correct and all the cells in the table should not be blank. Situations that can cause blank cells in a crash table include, but are not limited to; the year is not correct, a pivot table is not connected to the correct query, and/or an excel formula is incorrect. This check can help to guarantee that the information presented in each table is correct.

Once the process is complete, a pop-up window shows the file name and the file path where this PDF is created (figure 24). The destination of the PDF is set to the same folder address as the CF\_20XX\_VBA Excel file. If there was already a pdf file called 2017.pdf, the new 2017.pdf file will replace the old 2017.pdf by clicking the Action 4 button. The VBA code of Action 4 is attached in Appendix A Code A4.

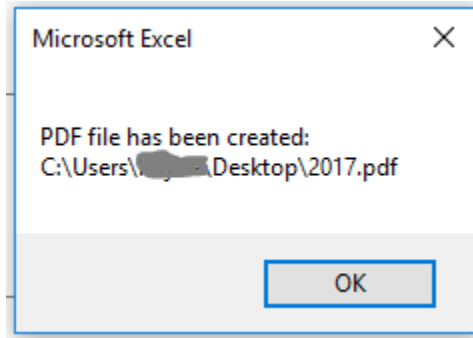


Figure 24. A message shows the location of a newly created PDF file.

Sheet 16 is a special crash table in CF\_2017\_VBA Excel file. The VBA code of Action 4 includes a function that hides the rows in sheet 16. This was added due to a new requirement issued by the Iowa DOT. They want the data of crashes for all twenty-one combinations of non-motorist types involved in the same crash to be shown on the Crashes Involving Non-Motorist table. Before hiding the rows, the table looks like this (figure 25).



Crashes Involving Non-Motorist* State of Iowa 2017						
Non-Motorist Type	Crash Severity					Total Crashes
	Fatal	Major Injury	Minor Injury	Possible Injury	Property Damage Only	
Pedestrian	24	59	180	136	3	402
Pedalcyclist	5	37	185	108	1	336
Pedalcycle Passenger	0	0	0	0	0	0
In or On Building	0	0	0	1	0	1
Horse and Buggy	0	2	3	1	0	6
Skater, Personal Conveyance, Wheelchair	0	0	3	6	0	9
Other	2	9	6	6	9	32
Unknown	0	0	0	0	3	3
Not Reported	0	0	0	0	0	0
Pedestrian/Pedalcyclist	0	0	0	0	0	0
Pedestrian/Pedalcycle Passenger	0	0	0	0	0	0
Pedestrian/In or On Building	0	0	0	0	0	0
Pedestrian/Horse and buggy	0	0	0	0	0	0
Pedestrian/Skater, Personal Conveyance, Wheelchair	0	0	0	0	0	0
Pedestrian/Other	0	0	0	0	0	0
Pedalcyclist/Pedalcycle Passenger	0	1	0	0	0	1
Pedalcyclist/In or On Building	0	0	0	0	0	0
Pedalcyclist/Horse and buggy	0	0	0	0	0	0
Pedalcyclist/Skater, Personal Conveyance, Wheelchair	0	0	0	0	0	0
Pedalcyclist/Other	0	0	0	0	0	0
Pedalcycle Passenger/In or On Building	0	0	0	0	0	0
Pedalcycle Passenger/Horse and buggy	0	0	0	0	0	0
Pedalcycle Passenger/Skater, Personal Conveyance, Wheelchair	0	0	0	0	0	0
Pedalcycle Passenger/Other	0	0	0	0	0	0
In or On Building/Horse and buggy	0	0	0	0	0	0
In or On Building/Skater, Personal Conveyance, Wheelchair	0	0	0	0	0	0
In or On Building/Other	0	0	0	0	0	0
Horse and Buggy/Skater, Personal Conveyance, Wheelchair	0	0	0	0	0	0
Horse and Buggy/Other	0	0	0	0	0	0
Skater, Personal Conveyance, Wheelchair/Other	0	0	0	0	0	0
Total	31	108	377	258	16	790

\*Based on non-motorist type  
"/" indicates two different non-motorist types involved in the same crash

Figure 25. Crashes Involving Non-Motorist table in 2017 before hiding rows with zero value.

Each zero value shown should be hidden and not present to the public. The code in Action 4 can detect and hide the rows containing all zero values. figure 26 shows the table after clicking the button of Action 4. The code that unhides all the rows in sheet 16 is placed before the code that hides the rows that contain zero values. The purpose of this order is to include all the rows that have actual data.

Crashes Involving Non-Motorist* State of Iowa 2017						
Non-Motorist Type	Crash Severity					Total Crashes
	Fatal	Major Injury	Minor Injury	Possible Injury	Property Damage Only	
Pedestrian	24	59	180	136	3	402
Pedalcyclist	5	37	185	108	1	336
Pedalcycle Passenger	0	0	0	0	0	0
In or On Building	0	0	0	1	0	1
Horse and Buggy	0	2	3	1	0	6
Skater, Personal Conveyance, Wheelchair	0	0	3	6	0	9
Other	2	9	6	6	9	32
Unknown	0	0	0	0	3	3
Not Reported	0	0	0	0	0	0
Pedalcyclist/Pedalcycle Passenger	0	1	0	0	0	1
<b>Total</b>	<b>31</b>	<b>108</b>	<b>377</b>	<b>258</b>	<b>16</b>	<b>790</b>

\*Based on non-motorist type  
"/" indicates two different non-motorist types involved in the same crash

Figure 26. Crashes Involving Non-Motorist table in 2017 after clicking Action 4.

## Fatalities and Crash Trend Template

After the Excel template to create Crash Detail tables is done, the PDF files of the last 10 years of Crash Detail tables are available. All the PDF files needed for Crash Detail are ready.

The next step is to create a template that generates the fatalities and crash trend tables and combines all the PDFs into a Crash Facts Report.

That Excel template is named CrashFactsReport\_VBA – 20XX. The Excel file contains a user interface, fatalities table, a cover sheet for crash trend tables, and eleven separate crash trend tables. A screenshot of all the sheet tabs is attached below in figure 27.

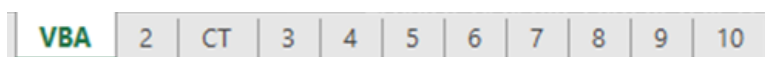


Figure 27. Sheet tabs of CrashFactsReport\_VBA – 20XX file

The VBA sheet contains a user interface called CrashFacts Report - PDF Generation Tool (figure 28). This user interface is designed to guide the user in creating two PDFs. The PDFs are the Fatalities and Crash Trend and the Crash Facts Report. Each tab generates a single page PDF, with one or two tables.

	A	B	C	D
1		CrashFacts Report - PDF Generation Tool		
2		*To stop running any code, press Ctrl + Break		
3				
4		Current Yr File Change	<b>Action 1: Update number of current year and database file path for latest year, either manually change the path or click the button left.</b> Current Year: 2017 Current Year Access Database File Path: C:\Users\2017.mdb	<b>Action 3: Update Pivot Table by year or Update All</b> Current Yr Update
5				
6		<b>Action 2: Update database files for past 9 years, either manually change the path or click the button left.</b>		
7		1st Yr File Change	1st year: 2008 1st year Access Path: C:\Users\IowaCrash2005to2009.mdb	1st Yr Update
8		2nd Yr File Change	2nd year: 2009 2nd year Access Path: C:\Users\IowaCrash2005to2009.mdb	2nd Yr Update
9		3rd Yr File Change	3rd year: 2010 3rd year Access Path: C:\Users\IowaCrash2010to2014.mdb	3rd Yr Update
10		4th Yr File Change	4th year: 2011 4th year Access Path: C:\Users\IowaCrash2010to2014.mdb	4th Yr Update
11		5th Yr File Change	5th year: 2012 5th year Access Path: C:\Users\IowaCrash2010to2014.mdb	5th Yr Update
12		6th Yr File Change	6th year: 2013 6th year Access Path: C:\Users\IowaCrash2010to2014.mdb	6th Yr Update
13		7th Yr File Change	7th year: 2014 7th year Access Path: C:\Users\IowaCrash2010to2014.mdb	7th Yr Update
14		8th Yr File Change	8th year: 2015 8th year Access Path: C:\Users\2015.mdb	8th Yr Update
15		9th Yr File Change	9th year: 2016 9th year Access Path: C:\Users\2016.mdb	9th Yr Update
16				
17		<b>Action 4: Update Year Code</b>	<b>Action 4: Update 2016 year code from YEAR_ to CRASH_YEAR(before 2016 is YEAR_ after 2016 is CRASH_YEAR)</b> To Do: Click the button left, Wait for the message "Done!" After Action 4: All the 2016 Pivot tables formula related to year code updated.	Update All 10 years
18		Pre-request: Manually Check every sheet first		
19		<b>Action 5: Create 2017 Fatal&amp;CrashTrend.pdf from Sheet 2 to Sheet 10</b> To Do: Click the button below, Wait for the message "Done!" After Action 5: The Fatal&CrashTrend_2017.pdf file will be created in The same folder where CrashFactsReport_VBA - 2017 Excel file is. file Path will be updated in cell below.		
20		Fatal&CrashTrend.pdf Location: C:\Users\Fatal&CrashTrend_2017.pdf		
21		<b>Action 5: Create Fatal &amp; Crash Trend PDF</b>		
22		Pre-request: Check if all the pdfs are ready to combine together in the same folder as this Excel file		
23		<b>Action 6: Create 2017 CrashFacts Report from Cover.pdf, Fatal&amp;CrashTrend_2017.pdf, 2008.pdf, 2009.pdf, 2010.pdf, 2011.pdf, 2012.pdf, 2013.pdf, 2014.pdf, 2015.pdf, 2016.pdf, 2017.pdf</b> To Do: Click the button below, Wait for the message "Done!" After Action 6: The CrashFacts_2017 PDF file will be created in the same folder where CrashFactsReport_VBA - 2017 file is. File Path will be updated in cell below.		
24		CrashFacts Report Location: C:\Users\CrashFacts_2017_20210522_1217.pdf		
25		<b>Action 6: Generate Current Year's Crash Facts Report</b>		

Figure 28. User interface on Sheet VBA in CrashFactsReport\_VBA – 20XX.

The Sheet CT shows two words, Crash Trend (figure 29).

# Crash Trend

Figure 29. Sheet CT in CrashFactsReport\_VBA – 20XX.

In total, 9 sheets are included in this Excel file from Sheet 2 to Sheet 10. These sheets populate all crash trend tables with the crash data from 2008 to 2017. The layout of each table is the same as the crash history table in figure 15. Each crash table links with the correct pivot tables. Each pivot table connects with the correct query. All the code written in this file can be applied to any year. This Excel template can be used to create all crash trend tables for any year. Any person can follow the instructions to create an Iowa Crash Facts Report. The user interface in this template includes five actions with twenty-four buttons.

**Action 1:** The first action is updating the file path of the current year's database. The current year must match the year of the Crash Facts Report that the user wants to generate. The user can manually change the file path of the current year database or click "Current Yr File Change" to select the correct database. The pop-up window is the same as the window in figure 19. The code is similar to the Action 1 in CF\_20XX file. If no file is selected and the user clicks Open, the program runs nothing and exits. When a valid file is selected, the file path of this selected file will be updated in Cell C5 in figure 28. Cell C5 displays the file path of the file just selected.

The user can change the year in Cell C4 to start creating the Crash Facts Report for a new year. The year information on each page is set to be equal to Cell C4. The CrashFactsReport\_VBA – 2017 file can be copied and pasted to create CrashFactsReport\_VBA – 2018 file. This is done by changing Cell C4 from 2017 to 2018 and following the instructions from Action 1 to Action 6. The VBA code written for Action 1 is attached in Appendix B Code B1.

**Action 2:** The second action is updating the file paths of the databases for the other 9 years. When creating the 2017 Crash Facts Report, 2017 is the "current year" and 2008 to 2016

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are the past 9 years. The logic and the code behind each file change button are the same as the “Current Yr File Change” button in Action 1. The VBA code written for Action 2 is attached in Appendix B Code B2.

**Action 3:** The third action is updating the query connected to each pivot table in CrashFactsReport\_VBA - 20XX. Since the query creation process is done in Action 2 of CF\_20XX\_VBA file, there is no query that needs to be created in CrashFactsReport\_VBA - 20XX. All of the necessary queries to create crash trend tables are in each Access Database. The VBA code written for Action 3 is attached in Appendix B Code B2.

Not all the buttons in Action 2 and Action 3 are required. If the 2017 Crash Facts Report is already created and there is an update in 2016 Crash data, the user can simply click the button for 2016 Yr File Change in Action 2 and click the button for 2016 Yr Update in Action 3. This will update the 2016 crash data for all crash trend tables.

When the CrashFactsReport\_VBA - 20XX file is used to generate a Crash Facts Report for a new year, the user can click all nine buttons in Action 2 and the “Update All 10 years” button in Action 3. This will update all the tables in the Crash Trend section.

The VBA code for updating each year is the same except for the year attribute name. The code checks the year information, due to the code sheet change in 2015. If the year is older than 2016, the year field is named “YEAR\_”. If the year is 2016 or newer, the year field is called “CRASH\_YEAR”.

The code “Range(“A1”).Copy Range(“A1”)” is added to the end of the third, sixth and ninth year code. This is to clear the operation memory and to keep the core processing.

---

After this action, all 10-year crash trend tables and pivot tables are updated. It takes about five minutes to update all two hundred and thirty pivot tables for all ten years. This is the action that takes the most time to run. The message of “Done!” shows up at the end (figure 21).






**Action 4.** The fourth action is updating the year code in the crash table. The year code in pivot table is updated in Action 3, but may not update in the Excel function for each crash table. If the tool is used to create a Crash Facts Report for a new year, cells that are related to 2016 in all crash tables show zero values. The year code in the Excel function for the year before 2016 is “YEAR\_” (figure 30) and for the year in 2016 and after is “CRASH\_YEAR” (figure 31). When the tool is used to update a Crash Facts Report that is created before 2016, this action is not needed.

The screenshot shows an Excel spreadsheet with the following data:




Fatalities by County State of Iowa											
County	Years										Total
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Adair	3	6	2	4	4	2	5	0	5	2	33
Adams	1	2	1	1	2	0	2	1	0	0	10

The formula bar for cell J6 shows: `=IFERROR(GETPIVOTDATA("FATALITIES",$B$5,"COUNTY",$Q6,"YEAR_",J$5),0)`. The year code "YEAR\_" is highlighted in blue in the original image.

Figure 30. Year code shows in Excel function before 2016.

AutoSave Off     CrashFactsReport\_VBA - 2017 

File Home Insert Page Layout Formulas Data Review View Developer Help

K6    =IFERROR(GETPIVOTDATA("FATALITIES",\$B\$5,"COUNTY",\$Q6,"CRASH\_YEAR",K\$5),0)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2		Fatalities by County State of Iowa											
3													
4		County	Years									Total	
5			2008	2009	2010	2011	2012	2013	2014	2015	2016		2017
6		Adair	3	6	2	4	4	2	5	0	5	2	33
7		Adams	1	2	1	1	2	0	2	1	0	0	10

Figure 31. Year code shows in Excel function in 2016 and after.

The code in Action 4 finds the new rows or columns and replaces “YEAR\_” with “CRASH\_YEAR” in the Excel functions for the whole row or column in each sheet. The message of “Done!” shows up after this action is done (figure 21). The VBA code of Action 4 is attached in Appendix B Code B4.

**Action 5.** The fifth action is converting the ten sheets, sheets 2 to 10 and the cover sheet, into Fatal&CrashTrend\_20XX.pdf. This is similar to Action 4 in CF\_20XX\_VBA file. The user should manually check every table. Once the process is complete, a pop-up window shows the file name and the file path where this PDF is created (figure 32). The destination of the PDF is set to the same folder address as where the CF\_20XX\_VBA Excel file is located. If there is a pdf file called Fatal&CrashTrend\_2017.pdf, the new 2017 file will replace the old 2017 file by clicking the Action 5. The VBA code of Action 5 is attached in Appendix B Code B5.

**Action 6.** The sixth 6 is combining all the available PDF files into a Crash Facts Report. The PDF file in the Cover section, a PDF created by CrashFactsReport\_VBA file, and ten PDFs created by CF\_20XX\_VBA file form the complete Crash Facts Report (figure 32).



Figure 32. The report generation process of Action 6 in CrashFactsReport\_VBA – 2017.

If any of the required PDF files are missing, the message of "Could not create PDF file" shows. The VBA code in this Action retrieves current time information and adds it to the name of the Crash Facts Report. The Crash Facts Report is created in the folder where CrashFactsReport\_VBA - 2017 file is.



## CONCLUSION AND DISCUSSION

The Crash Facts Report Generator, that I have created, saves learning time, human error checking time, and report creation time. It allows the user to create a new Crash Facts Report or update the report for a specific year, effortlessly. The entire operation takes less than five minutes instead of a couple of weeks.

Though, there are three drawbacks of this program. First, the cover page and table of contents in the Cover section is not automated. The user is required to manually update the year information and page information. A module could be added to update the year information, page information, and the header and footer. Second, if there is an update on the code sheet in the future, the user will need to learn the similarities and differences between the old and the new code sheet. A code validation module can be added in the future to detect the differences. Third, the current crash tables only display data in numbers. It can be hard for the audience to understand the message behind the tables. Line graphs, bar charts, and data cards could be added to present the crash data in a more visually appealing way.

With the current design, three things can be improved. The first thing is the two templates could be merged into one template. The second thing is the ten year's update code (Appendix B CodeB3), which could detect the year automatically and shorten the operating time. The last thing could be to merge the "Update Year Code" (Appendix B Code B4) to a for loop to shorten the code instead of repeating for each sheet.

For the future design of the CFRG, I created a word document called "Excel Tool Change Instruction." It contains instructions on how to change the file location, file name, sheet name,

---

content on the VBA sheet, and how to update a sheet.<sup>26</sup> There is also an included standard format which I used to create the crash table. There are also two-button code reference tables. I also created an “Excel Tool Error and Solution” file. This file recorded all the errors I have encountered during the process of creating the CFRG, as well as my solutions to these problems. These two documents were created to guide the data specialist to improve this tool in the future if needed.

---

<sup>26</sup> Yue He, “Excel Tool Change Instruction.” Instruction Manual, private collection of InTrans, 2021

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## APPENDIXES

### APPENDIX A VBA Code used in CF\_20XX\_VBA

#### *Code A1. Action 1: Update 20XX Access Database*

---

```
Sub Start_Click()  
    'Action 1 Button  
    Dim SrPath, NewYr, fs, SrName  
    NewYr = Sheet1.Range("C4")  
    'Get the Source File Path  
    SrPath = Application.GetOpenFilename>Title:="Choose the new Access Source File for " & NewYr)  
    If SrPath <> False Then  
        Sheet1.Range("C5") = Sheet1.Range("C6")  
        Sheet1.Range("C6") = SrPath  
    Else  
        Exit Sub  
    End If  
  
    'Get source file name  
    Set fs = CreateObject("Scripting.FileSystemObject")  
    SrName = fs.GetFileName(SrPath)  
    Sheet1.Range("C7") = SrName  
  
    MsgBox "Done!"  
End Sub
```

---

*Code A2. Action 2: Copy All Queries*


---

```

Sub QueryCopy_Click()
'Action 2 Button
'DoCmd.CopyObject (DestinationDatabase, NewName, SourceObjectType, SourceObjectName)
'Speed
Application.ScreenUpdating = False
Application.DisplayStatusBar = False
Application.EnableEvents = False
ActiveSheet.DisplayPageBreaks = False
Dim OldA, NewA
Dim appAccess As Access.Application
Set appAccess = CreateObject("Access.Application")
OldA = Sheet1.Range("C5")
If OldA = False Then
MsgBox "Please click Action 1 to update the new Access Database path first then click Action 2"
Exit Sub
End If
NewA = Sheet1.Range("C6")
Dim qdf As QueryDef
With appAccess|
.Visible = False
.OpenCurrentDatabase OldA
.DoCmd.CopyObject NewA, , acTable, "Cross Reference by Age" 'Table
For Each qdf In CurrentDb.QueryDefs
.DoCmd.CopyObject NewA, , acQuery, qdf.Name
Next qdf
End With
Set appAccess = Nothing
MsgBox "Done!"
'Speed
Application.ScreenUpdating = True
Application.DisplayStatusBar = True
Application.EnableEvents = True
End Sub

```

---

*Code A3. Action 3: Update All Tables*

```

Sub UpdateConnection_Click()
'Action 3
'Speed
Application.ScreenUpdating = False
Application.DisplayStatusBar = False
Application.EnableEvents = False
ActiveSheet.DisplayPageBreaks = False
' Unhide sheet 16 rows
Sheet16.Rows("16:37").EntireRow.Hidden = False
' Change connection to new source Access File
Dim SrPath, pf, pi As String
Dim pt As PivotTable, s As Worksheet
SrPath = Sheet1.Range("C6") 'File Path
pi = Sheet1.Range("C4") 'Year
If pi < 2016 Then
pf = "YEAR_" 'Year code
Else
pf = "CRASH_YEAR"
End If
Dim c As WorkbookConnection
For Each c In ActiveWorkbook.Connections
c.OLEDBConnection.BackgroundQuery = False
c.OLEDBConnection.connection = _
"OLEDB;Provider=Microsoft.ACE.OLEDB.12.0;Data Source=" & SrPath & ";Mode=Read;"
'Extended Properties="";Jet OLEDB:System database="";Jet OLEDB:Registry Path="";
c.OLEDBConnection.SourceConnectionFile = SrPath
c.Refresh
c.OLEDBConnection.MaintainConnection = False
Next

```

---

```

On Error GoTo Error_Handler
For Each s In ThisWorkbook.Worksheets
    For Each pt In s.PivotTables
        Dim field As PivotField
        Set field = pt.PivotFields(pf)
        With field
            .Orientation = xlColumnField
            .ClearAllFilters
            .PivotFilters.Add2 Type:=xlCaptionEquals, Value1:=pi
        End With
    Next
Next
MsgBox "Done!"

Error_Handler_Exit:
    On Error Resume Next
    MsgBox "Errors List Finished!"
    Exit Sub

Error_Handler:
    MsgBox "The following error has occurred." & vbCrLf & vbCrLf & _
        "Error Number: " & Err.Number & vbCrLf & _
        "Error PivotTable: " & pt.Name & vbCrLf & _
        "Error Sheet: " & s.Name & vbCrLf & _
        "Error Description: " & Err.Description, _
        vbCritical, "An Error has Occurred!"
    Resume Error_Handler_Exit

'Speed
Application.ScreenUpdating = True
Application.DisplayStatusBar = True
Application.EnableEvents = True
End Sub

```

---



***Code A4. Action 4: Create 20XX.pdf***

```

Sub PDF_Click()
'Action 4 Button
'Speed
Application.ScreenUpdating = False
Application.DisplayStatusBar = False
Application.EnableEvents = False
ActiveSheet.DisplayPageBreaks = False
'Unhide all the rows and columns
Dim s As Worksheet
For Each s In ThisWorkbook.Worksheets
s.Columns.EntireColumn.Hidden = False
s.Rows.EntireRow.Hidden = False
Next
' Unhide sheet 16 rows
Sheet16.Rows("16:37").EntireRow.Hidden = False
'Hide Rows in Sheet16
Dim x, y
For y = 16 To 36
x = Sheet16.Cells(y, "C").Value + Sheet16.Cells(y, "D").Value
+ Sheet16.Cells(y, "E").Value + Sheet16.Cells(y, "F").Value + Sheet16.Cells(y, "G").Value
If x = 0 Then
Sheet16.Rows(y).Hidden = True
Else
Sheet16.Rows(y).Hidden = False
End If
Next y
'Create pdf
Dim wbA As Workbook
Dim strPath As String
Dim strFile As String
Dim strPathFile As String
Dim i As Integer
Dim NewYr
NewYr = Sheet1.Range("C4")
On Error GoTo errHandler

Set wbA = ThisWorkbook

'get active workbook folder, if saved
strPath = wbA.Path
If strPath = "" Then
strPath = Application.DefaultFilePath
End If
strPath = strPath & "\"

strFile = NewYr & ".pdf"
strPathFile = strPath & strFile

ThisWorkbook.Sheets(Array("Cover", "11", "12", "13", "14", "15", _
"16", "17", "18", "19", "20", "21", "22", "23", "24", "25", "26"))_Select

```

---

```

ActiveSheet.ExportAsFixedFormat _
    Type:=xlTypePDF, _
    Filename:=strPathFile, _
    Quality:=xlQualityStandard, _
    IncludeDocProperties:=True, _
    IgnorePrintAreas:=False, _
    OpenAfterPublish:=False
'confirmation message with file info
MsgBox "PDF file has been created: " _
    & vbCrLf _
    & strPathFile
' Come back with the first sheet interface
ThisWorkbook.Sheets(1).Select
Sheet1.Range("C8") = strPathFile

exitHandler:
    Exit Sub
errHandler:
    MsgBox "Could not create PDF file"
    Resume exitHandler
'Speed
Application.ScreenUpdating = True
Application.DisplayStatusBar = True
Application.EnableEvents = True
End Sub

```

---

**APPENDIX B VBA Code used in CrashFactsReport\_VBA - 20XX***Code B1. Action 1: Current Yr File Change*

---

```
Sub CurrentYr_Click()  
    'Action 1 Button  
    Dim SrPath, NewYr  
    NewYr = Sheet1.Range("C4")  
    'Get the Source File Path  
    SrPath = Application.GetOpenFilename _  
        (Title:="Choose the new Access Source File for " & NewYr)  
    If SrPath <> False Then  
        Sheet1.Range("C5") = SrPath  
        MsgBox "Done!"  
    End If  
End Sub
```

---

***Code B2. Action 2: Update file paths for past 9 years***

```

Sub Yr1_Click()
'Action 2 Button
Dim SrPath, Yr
Yr = Sheet1.Range("C7")
'Get the Source File Path
SrPath = Application.GetOpenFilename(Title:="Choose the new Access Source File for " & Yr)
If SrPath <> False Then
Sheet1.Range("C8") = SrPath
MsgBox "Done!"
End If
End Sub

```

---

```

Sub Yr2_Click()
'Action 2 Button
Dim SrPath, Yr
Yr = Sheet1.Range("C9")
'Get the Source File Path
SrPath = Application.GetOpenFilename(Title:="Choose the new Access Source File for " & Yr)
If SrPath <> False Then
Sheet1.Range("C10") = SrPath
MsgBox "Done!"
End If
End Sub

```

---

```

Sub Yr3_Click()
'Action 2 Button
Dim SrPath, Yr
Yr = Sheet1.Range("C11")
'Get the Source File Path
SrPath = Application.GetOpenFilename(Title:="Choose the new Access Source File for " & Yr)
If SrPath <> False Then
Sheet1.Range("C12") = SrPath
MsgBox "Done!"
End If
End Sub

```

---

```

Sub Yr4_Click()
'Action 2 Button
Dim SrPath, Yr
Yr = Sheet1.Range("C13")
'Get the Source File Path
SrPath = Application.GetOpenFilename(Title:="Choose the new Access Source File for " & Yr)
If SrPath <> False Then
Sheet1.Range("C14") = SrPath
MsgBox "Done!"
End If
End Sub

```

---

---

```
Sub Yr5_Click()  
'Action 2 Button  
Dim SrPath, Yr  
Yr = Sheet1.Range("C15")  
'Get the Source File Path  
SrPath = Application.GetOpenFilename(Title:="Choose the new Access Source File for " & Yr)  
If SrPath <> False Then  
Sheet1.Range("C16") = SrPath  
MsgBox "Done!"  
End If  
End Sub
```

---

```
Sub Yr6_Click()  
'Action 2 Button  
Dim SrPath, Yr  
Yr = Sheet1.Range("C17")  
'Get the Source File Path  
SrPath = Application.GetOpenFilename(Title:="Choose the new Access Source File for " & Yr)  
If SrPath <> False Then  
Sheet1.Range("C18") = SrPath  
MsgBox "Done!"  
End If  
End Sub
```

---

```
Sub Yr7_Click()  
'Action 2 Button  
Dim SrPath, Yr  
Yr = Sheet1.Range("C19")  
'Get the Source File Path  
SrPath = Application.GetOpenFilename(Title:="Choose the new Access Source File for " & Yr)  
If SrPath <> False Then  
Sheet1.Range("C20") = SrPath  
MsgBox "Done!"  
End If  
End Sub
```

---

```
Sub Yr8_Click()  
'Action 2 Button  
Dim SrPath, Yr  
Yr = Sheet1.Range("C21")  
'Get the Source File Path  
SrPath = Application.GetOpenFilename(Title:="Choose the new Access Source File for " & Yr)  
If SrPath <> False Then  
Sheet1.Range("C22") = SrPath  
MsgBox "Done!"  
End If  
End Sub
```

---

```
Sub Yr9_Click()  
'Action 2 Button  
Dim SrPath, Yr  
Yr = Sheet1.Range("C23")  
'Get the Source File Path  
SrPath = Application.GetOpenFilename(Title:="Choose the new Access Source File for " & Yr)  
If SrPath <> False Then  
Sheet1.Range("C24") = SrPath  
MsgBox "Done!"  
End If  
End Sub
```

***Code B3. Action 3: Update the pivot tables***


---

```

Function uall(SrPath, pt, pf, pi)
Dim c As WorkbookConnection
    Set c = pt.PivotCache.WorkbookConnection
    c.OLEDBConnection.BackgroundQuery = False
    c.OLEDBConnection.connection = "OLEDB;Provider=Microsoft.ACE.OLEDB.12.0;Data Source=" & SrPath & ";Mode=Read"
    c.OLEDBConnection.SourceConnectionFile = SrPath
    c.Refresh
    c.OLEDBConnection.MaintainConnection = False
Dim field As PivotField
Set field = pt.PivotFields(pf)
With field
    .Orientation = xlColumnField
    .ClearAllFilters
    .PivotFilters.Add2 Type:=xlCaptionEquals, Value1:=pi
End With
End Function

```

---

```

Sub All_Click()
'Speed
ActiveSheet.DisplayPageBreaks = False
Application.ScreenUpdating = False
Application.DisplayStatusBar = False
Application.EnableEvents = False
On Error Resume Next
Dim SrPath, pf, pi As String
Dim pt As PivotTable
.....'1st year
pi = Sheet1.Range("C7") 'Year
SrPath = Sheet1.Range("C8") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If

```

---

```
Set pt = Sheet2.PivotTables("PivotTable12")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable22")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable33")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable45")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable43")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable1")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable15")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable24")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable33")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable43")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable52")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable62")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable71")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable81")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable101")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable90")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable110")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable121")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable130")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable140")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable149")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable158")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable168")
Call uall(SrPath, pt, pf, pi)
'MsgBox "1st year Done!"
```

---

```

.....'2nd year
pi = Sheet1.Range("C9") 'Year
SrPath = Sheet1.Range("C10") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If

Set pt = Sheet2.PivotTables("PivotTable17")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable23")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable34")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable46")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable44")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable2")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable16")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable25")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable34")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable44")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable53")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable63")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable72")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable82")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable102")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable91")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable111")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable122")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable131")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable141")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable150")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable159")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable169")
Call uall(SrPath, pt, pf, pi)
'MsgBox "2nd year Done!"

```

---



```

.....
.....'3rd year
pi = Sheet1.Range("C11") 'Year
SrPath = Sheet1.Range("C12") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If

Set pt = Sheet2.PivotTables("PivotTable14")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable24")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable36")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable47")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable54")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable4")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable17")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable26")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable35")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable45")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable55")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable64")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable73")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable83")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable103")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable92")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable112")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable123")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable132")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable142")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable151")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable160")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable170")
Call uall(SrPath, pt, pf, pi)
'MsgBox "3rd year Done!"
Range("A1").Copy Range("A1")

```

---

```

.....'4th year
pi = Sheet1.Range("C13") 'Year
SrPath = Sheet1.Range("C14") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If
Set pt = Sheet2.PivotTables("PivotTable18")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable25")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable37")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable48")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable55")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable3")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable18")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable27")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable36")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable46")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable56")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable65")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable75")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable84")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable104")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable93")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable113")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable124")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable133")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable143")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable152")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable161")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable171")
Call uall(SrPath, pt, pf, pi)
'MsgBox "4th year Done!"

```

---

```

.....'5th year
pi = Sheet1.Range("C15") 'Year
SrPath = Sheet1.Range("C16") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If
Set pt = Sheet2.PivotTables("PivotTable19")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable26")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable38")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable49")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable56")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable5")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable19")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable28")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable37")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable47")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable57")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable66")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable76")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable85")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable105")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable94")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable114")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable125")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable134")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable144")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable153")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable162")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable172")
Call uall(SrPath, pt, pf, pi)
'MsgBox "5th year Done!"

```

---

```

.....'6th year
pi = Sheet1.Range("C17") 'Year
SrPath = Sheet1.Range("C18") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If
Set pt = Sheet2.PivotTables("PivotTable20")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable27")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable39")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable50")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable57")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable6")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable20")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable29")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable38")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable48")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable58")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable67")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable77")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable86")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable106")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable95")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable115")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable126")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable135")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable145")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable154")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable163")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable173")
Call uall(SrPath, pt, pf, pi)
'MsgBox "6th year Done!"
Range("A1").Copy Range("A1")

```

```

Range( "A1" ).Copy Range( "A1" ,
.....'7th year
pi = Sheet1.Range("C19") 'Year
SrPath = Sheet1.Range("C20") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If

Set pt = Sheet2.PivotTables("PivotTable21")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable28")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable40")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable51")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable58")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable10")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable21")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable30")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable39")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable49")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable59")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable68")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable78")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable87")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable107")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable96")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable116")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable127")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable136")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable146")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable155")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable164")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable174")
Call uall(SrPath, pt, pf, pi)
'MsgBox "7th year Done!"

```

```

.....'8th year
pi = Sheet1.Range("C21") 'Year
SrPath = Sheet1.Range("C22") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If

Set pt = Sheet2.PivotTables("PivotTable15")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable31")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable41")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable53")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable59")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable12")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable22")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable31")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable40")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable50")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable60")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable69")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable79")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable89")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable108")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable97")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable117")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable128")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable138")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable147")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable156")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable166")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable9")
Call uall(SrPath, pt, pf, pi)
'MsgBox "8th year Done!"

```

---



```

----- 4 -----
.....'9th year
pi = Sheet1.Range("C23") 'Year
SrPath = Sheet1.Range("C24") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If

Set pt = Sheet2.PivotTables("PivotTable16")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable32")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable42")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable52")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable60")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable13")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable23")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable32")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable42")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable51")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable61")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable70")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable80")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable88")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable120")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable98")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable119")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable129")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable139")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable148")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable157")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable167")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable175")
Call uall(SrPath, pt, pf, pi)
'MsgBox "9th year Done!"
Range("A1").Copy Range("A1")

```

---

```

.....'10th year
pi = Sheet1.Range("C4") 'Year
SrPath = Sheet1.Range("C5") 'File Path
If pi < 2016 Then
pf = "YEAR_"
Else
pf = "CRASH_YEAR"
End If
Set pt = Sheet2.PivotTables("PivotTable1")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable2")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet3.PivotTables("PivotTable3")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable4")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet4.PivotTables("PivotTable5")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable7")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet5.PivotTables("PivotTable8")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable9")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable16")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable10")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet6.PivotTables("PivotTable15")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable1")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet7.PivotTables("PivotTable2")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable3")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable5")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable99")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet8.PivotTables("PivotTable6")
Call uall(SrPath, pt, pf, pi)

```

---



```
Set pt = Sheet9.PivotTables("PivotTable1")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable2")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable3")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet9.PivotTables("PivotTable4")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable5")
Call uall(SrPath, pt, pf, pi)
Set pt = Sheet10.PivotTables("PivotTable6")
Call uall(SrPath, pt, pf, pi)
'MsgBox "Current Year Done!"
MsgBox "Done!"
Application.ScreenUpdating = True
Application.DisplayStatusBar = True
Application.EnableEvents = True
End Sub
```

**Code B4. Action 4: Update Year Code**

```

Sub YearUpdate()
'Sheet2
Dim findCell
Dim y
'Unhide all the rows and columns
Dim s As Worksheet
For Each s In ThisWorkbook.Worksheets
s.Columns.EntireColumn.Hidden = False
s.Rows.EntireRow.Hidden = False
Next
Set findCell = Sheet2.Range("C5:L5").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Column
Sheet2.Range(Sheet2.Cells(6, y), Sheet2.Cells(104, y)).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
ReplaceFormat:=False
'Sheet3
Set findCell = Sheet3.Range("B6:B15").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet3.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
ReplaceFormat:=False
'Sheet4
Set findCell = Sheet4.Range("B6:B15").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet4.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
ReplaceFormat:=False
'Sheet5
Set findCell = Sheet5.Range("B6:B15").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet5.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
ReplaceFormat:=False
'Sheet6
Set findCell = Sheet6.Range("B7:B16").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet6.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
ReplaceFormat:=False
Set findCell = Sheet6.Range("B26:B35").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet6.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
ReplaceFormat:=False

```

---

```

'Sheet7
Set findCell = Sheet7.Range("B6:B15").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet7.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
    xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
    ReplaceFormat:=False
'Sheet8
Set findCell = Sheet8.Range("B7:B16").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet8.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
    xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
    ReplaceFormat:=False
Set findCell = Sheet8.Range("B26:B35").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet8.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
    xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
    ReplaceFormat:=False
'Sheet9
Set findCell = Sheet9.Range("B7:B16").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet9.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
    xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
    ReplaceFormat:=False
Set findCell = Sheet9.Range("B26:B35").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet9.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
    xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
    ReplaceFormat:=False
'Sheet10
Set findCell = Sheet10.Range("B6:B15").Find(What:="2016", LookIn:=xlValues, LookAt:=xlWhole)
y = findCell.Row
Sheet10.Range("C" & y & ":O" & y).Replace What:="YEAR_", Replacement:="CRASH_YEAR", LookAt:= _
    xlPart, SearchOrder:=xlByRows, MatchCase:=False, SearchFormat:=False, _
    ReplaceFormat:=False
MsgBox "Done!"
End Sub

```

---

**Code B5: Action 5: Create Fatal & Crash Trend PDF**

```

Sub PDF_Click()
'Action 5
Dim wbA As Workbook
Dim strPath As String
Dim strFile As String
Dim strPathFile As String
Dim NewYr
NewYr = Sheet1.Range("C4")
On Error GoTo errHandler
'Unhide all the rows and columns
Dim s As Worksheet
For Each s In ThisWorkbook.Worksheets
s.Columns.EntireColumn.Hidden = False
s.Rows.EntireRow.Hidden = False
Next
Set wbA = ThisWorkbook
'get active workbook folder, if saved
strPath = wbA.Path
If strPath = "" Then
strPath = Application.DefaultFilePath
End If
strPath = strPath & "\"

strFile = "Fatal&CrashTrend_" & NewYr & ".pdf"
strPathFile = strPath & strFile

ThisWorkbook.Sheets(Array("2", "CT", "3", "4", "5", "6", "7", "8", "9", "10")).Select
ActiveSheet.ExportAsFixedFormat _
    Type:=xlTypePDF, _
    Filename:=strPathFile, _
    Quality:=xlQualityStandard, _
    IncludeDocProperties:=True, _
    IgnorePrintAreas:=False, _
    OpenAfterPublish:=False
'confirmation message with file info
MsgBox "PDF file has been created: " _
    & vbCrLf _
    & strPathFile

ThisWorkbook.Sheets(1).Select
Sheet1.Range("C32") = strPathFile

exitHandler:
Exit Sub
errHandler:
MsgBox "Could not create PDF file"
Resume exitHandler

End Sub

```

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