

# The Most Dangerous Race: The Isle of Man TT



CSCI-E 64 / CS171: Visualization  
Spring 2013  
Project III Submission

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This process book may be commented on by anyone that has the link, and that link is:  
[CSCI-E 64 / CS 171 Project III Process Book - David Killeffer and Leo Mejia](#)

To see the Process Book we created for Project II, follow this link:  
[CSCI-E 64 / CS 171 Project II Process Book - David Killeffer and Leo Mejia](#)

To see all the data & source code we used for this project III, see our GitHub repository here:  
<https://github.com/rayden7/cs171-project03>

To see all the data & source code we used for our previous Project II, see that GitHub repository here:  
<https://github.com/rayden7/cs171-project02>

## 1. Introduction

The [Isle of Man TT](#) is perhaps the most famous (and infamous) race in all of motorsports. It is unique amongst all competitions for several reasons. Prize money is paltry. The competitors themselves are generally not famous, rich, or racing professionals (with rare exceptions). And the event itself is generally considered to be the most dangerous racing circuit in the world; since the first TT was conducted in 1907, [two hundred thirty nine riders](#) have lost their lives.

The races are conducted annually on the Isle of Man, a small independent protectorate of the United Kingdom located just west of England in the Irish Sea. Every year for The race events consist of a variety of classes of motorcycle races and are run on the [Snaefell Mountain Course](#), a 37.79 mile stretch of country roads barely 20 feet wide in most places, and lined with trees, lampposts, rocks walls, cliffs, and other perilous hazards. Races consist of anywhere from one to six laps (37.79 miles for single lap up to 226.38 miles for six laps) per race class, and riders will reach speeds in excess of 200 mph.

We were inspired by learning more about the individual competitors who race at the Isle of Man TT each year to do our project on a visualization of the race data provided on the official Isle of Man TT. The riders who compete in this race are truly incredible individuals that compete purely for the “pride and glory” of winning, and their drive and spirit is amazingly inspiring. We also were inspired by an excellent documentary about the race that followed the events of the 2011 race season called [TT3D: Closer To The Edge](#). This film gives an excellent insight into what these amazing competitors go through and experience during the annual two weeks of competition. And lastly, just for a bit of fun, we found these short videos to be jaw-droppingly incredible:

- [The Greatest Show On Earth](#)
- [Most-Extreme-Sport: Irish-Road-Racing, Ulster Grand Prix, North West 200](#)
- [The Road Warriors: Irish Road Racing and Southern 100, Isle of Man](#)
- [The Road Warriors 2: North West 200, Southern 100, Isle of Man TT](#)

We were also inspired by the very neat [MLB Hall of Fame Voting](#) visualization that was referred to in our Project II:

### MLB Hall of Fame Voting Trajectories

[Introduction](#) | [Instructions](#) | [Examples](#) | [Footnotes](#) | [About](#)

Player Name:

1,070 of 1,070 players selected.

[Clear query](#).

Name

Pos Yrs

G WAR

Batting:

AB

R

H

HR

RBI

SB

BB

BA

OBP

SLG OPS

Pitching:

W

L

ERA

WHIP

GS

SV

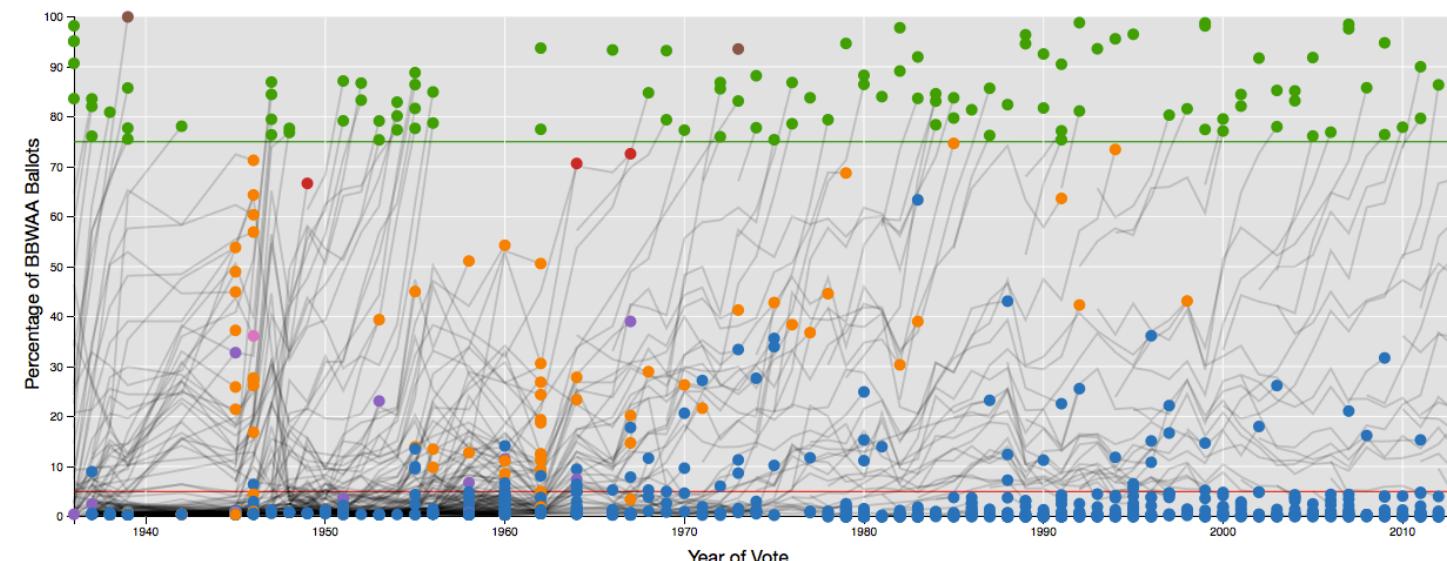
IP

H

HR

BB

SO



Inducted by:

- Not yet inducted
- BBWAA > 75%
- BBWAA Special Election
- BBWAA Runoff Election
- Veterans Committee (Player)
- Veterans Committee (Manager)
- Veterans Committee (Executive)
- Negro Leagues Committee

Position:

- P
- C
- 1B
- 2B
- 3B
- SS
- LF
- CF
- RF
- OF
- DH
- MGR
- Batters



## 2. Research Questions

The official [Isle of Man TT Database](#) website has a wealth of data on the competitors that have raced at the Isle of Man as well as the individual races and race classes. However, most of this information is locked away in HTML tables, and provides no real way to visualize a rider's competitive performance over time. For example, here's what the [2012 Dainese Superbike TT results](#) look like:

Race Results – The official Isle of Man TT website

www.iomtt.com/TT-Database/Events/Races.aspx?meet\_code=TT2012&race\_seq=1

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Bookmarks

**TT Database**

GRAHAM Official time until TT2012 25th May - 7th June 23D | 3H | 49M

**TT 2012 Dainese Superbike TT Race Results**

**TT 2012**

- » TT2012 Dainese Superbike TT Race
- » TT2012 Sure Sidecar Race 1
- » TT2012 Monster Energy Supersport TT Race 1
- » TT2012 Royal London 360 Superstock TT
- » TT2012 Sure Sidecar TT Race 2
- » TT2012 SES TT Zero Race
- » TT2012 Bikerpetition.co.uk Lightweight TT Race
- » TT2012 Monster Energy Supersport Race 2

Posn	No	Competitor	Machine	Time	Speed
1	1	John McGuinness	1000 Honda	1:46:03.06	128.078
2	4	Cameron DONALD	1000 Honda	1:46:17.92	127.78
3	5	Bruce Anstey	1000 Honda	1:47:00.22	126.938
4	3	Guy MARTIN	1000 Suzuki	1:47:20.18	126.544
5	7	Gary Johnson	1000 Honda	1:47:35.65	126.241
6	15	William Dunlop	1000 Honda	1:47:53.79	125.887
7	13	James Hillier	1000 KAWASAKI	1:49:01.23	124.589
8	6	Ian Hutchinson	1000 YAMAHA	1:49:41.52	123.827
9	46	Dean Harrison	1000 BMW	1:50:11.13	123.272
10	9	Michael Dunlop	1000 Honda	1:50:18.92	123.127
11	16	Daniel Kneen	1000 Suzuki	1:50:22.17	123.067
12	24	Steve Mercer	1000 Honda	1:50:46.22	122.621
13	11	Dan Stewart	1000 Honda	1:50:54.36	122.471
14	32	David Johnson	1000 KAWASAKI	1:51:22.06	121.964
15	20	Davy Morgan	1000 Suzuki	1:51:46.73	121.515
16	26	Ian Mackman	1000 KAWASAKI	1:52:32.79	120.686
17	29	Stefano BONETTI	1000 KAWASAKI	1:53:04.31	120.125
18	28	Ian Pattinson	1000 BMW	1:53:23.19	119.792
19	38	Daniel Cooper	1000 Honda	1:53:24.46	119.77
20	60	Alessio Corradi	1000 BMW	1:53:45.41	119.402
21	86	Karl Harris	1000 Honda	1:54:28.91	118.646
...	...	...	...	...	...

**SEE MORE**

**5**

The TT Database also has detailed rider information pages, but unfortunately these pages only aggregate statistical performance data for a rider, and do not really provide a way to visualize how that rider compares to other competitors. For example, here is the rider detail page for John McGuinness, who won the 2012 Superbike TT mentioned previously:

The screenshot shows a web browser displaying the official Isle of Man TT website. The title bar reads "John McGuinness - Competitor...". The main content area is titled "Competitor Profile: John McGuinness".  
**TT Career Summary:**  
Position: 1 2 3 4 5 6 7 10 11 12 15 18 24 DNF  
No of times: 19 11 6 3 6 1 3 2 1 1 1 1 13  
**Full Results:**  
**Biography:**  
McGuinness, picked up win number 18 in the Dainese Superbike Race and win 19 in Monday's Royal London 360 Superstock race during TT 2012.  
Unfortunately due to the cancellation of the 2012 PokerStars Senior Race, McGuinness was unable to compete for his 20th TT victory this year.  
**Photo Gallery:**  
A grid of six small images showing John McGuinness with trophies and on a motorcycle.  
**Competitors:**  
» A B C D E F G H I J K L  
M N O P Q R S T U V W X  
Y Z  
**Competitors A-Z:**  
M  
M'Gimsey, H  
Macartney, C E  
Macaskill, John  
Macaya, I  
MacBride, Tony  
MacDonald, J A  
MacDonald, R L  
MacDonald, Angus  
MacDonald, Ian  
MacDonnell, M  
Mace, Steven  
Macfadzean, Alex  
MacFarlane, John  
Machan, G T  
Machin, Andrew  
Machin, Russ  
Machin, I  
**Your TT essentials:**  
Dongle In a Box  
Unlimited High Speed Mobile Internet on the move just £1 a day

As you can see, there is nothing that allows you to compare a rider's performance visually. Although John McGuiness is one of the best competitive racers at the Isle of Man, the only indication you can see from this page is that he has finished in first place 19 times. We wanted a way to visualize the performance of the competitors of the modern era of the TT (1991-present). We wanted to create a visualization that would enable the viewer to answer these questions:

#### Primary question:

- How long does it take a rider to gain proficiency with the Mountain Course sufficient to podium? (win first, second, or third place) Our current hypothesis is that it takes at least 3 years of competitive racing experience at the Isle of Man before a rider can win a podium spot, or finish in first place (this is based on anecdotal reports that appear in the [TT3D: Closer To The Edge](#) film, as well as other documentary sources)

#### Additional questions:

- Given the large number of rider deaths that have occurred over the course of the TT's history, are there any interesting observations we can make from the data that we can find that might suggest ways to enhance the safety of the race, and potentially save lives?
- How has an individual rider's performance at the Isle of Man TT changed over time? Have they been improving in a recognizable pattern? How do DNF ("Did Not Finish") race performances affect the overall trend lines?
- How does an individual rider's race performance history compare with other riders?
- How does the racing speed of an individual rider change over time? How does that speed vary by race class?

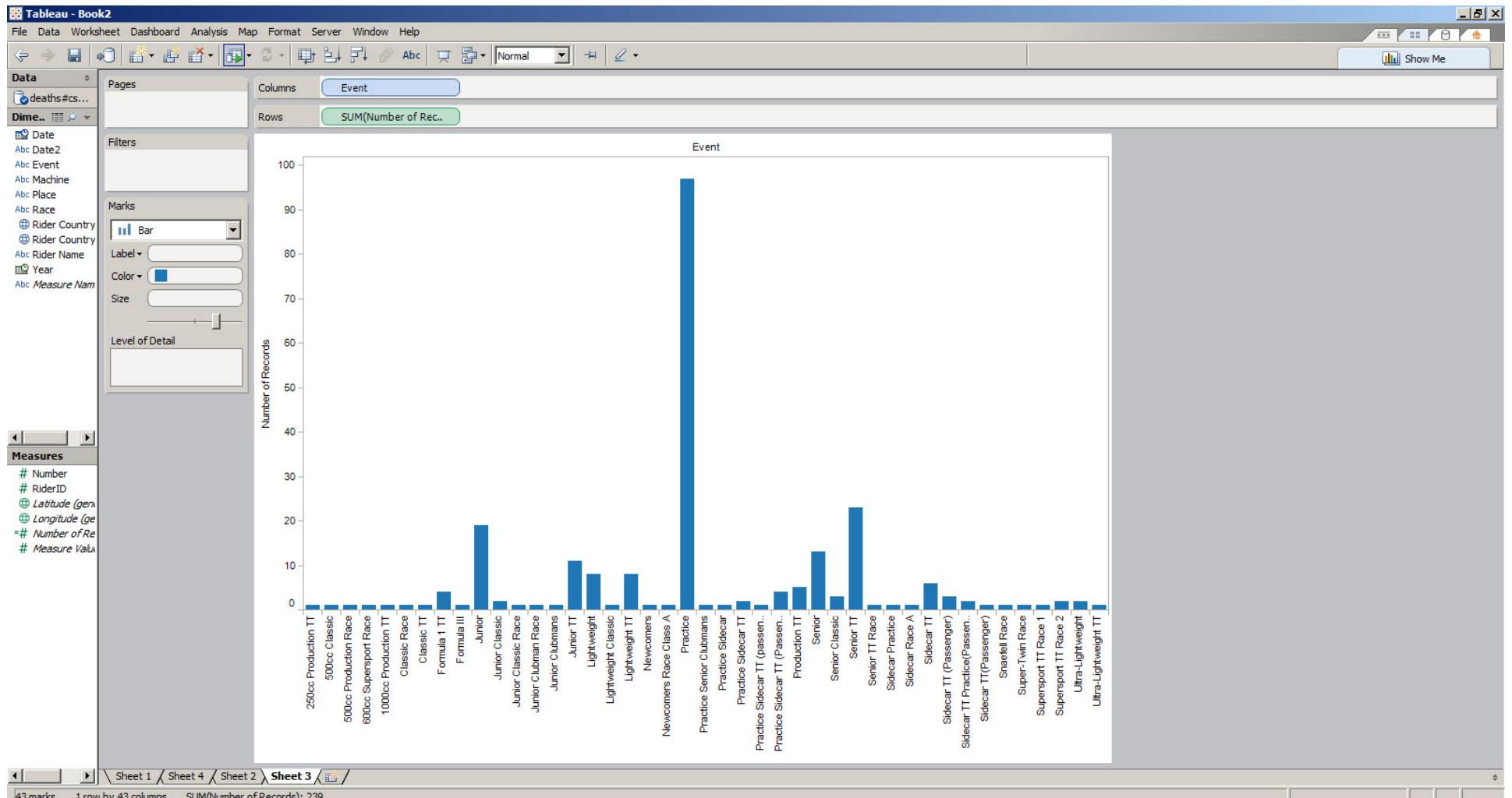
### 3. Data Analysis

As before in our Project II submission, we did several rounds of work in Tableau to experiment with the data and try to find interesting new visualizations from our new dataset. In Project II we had two datasources:

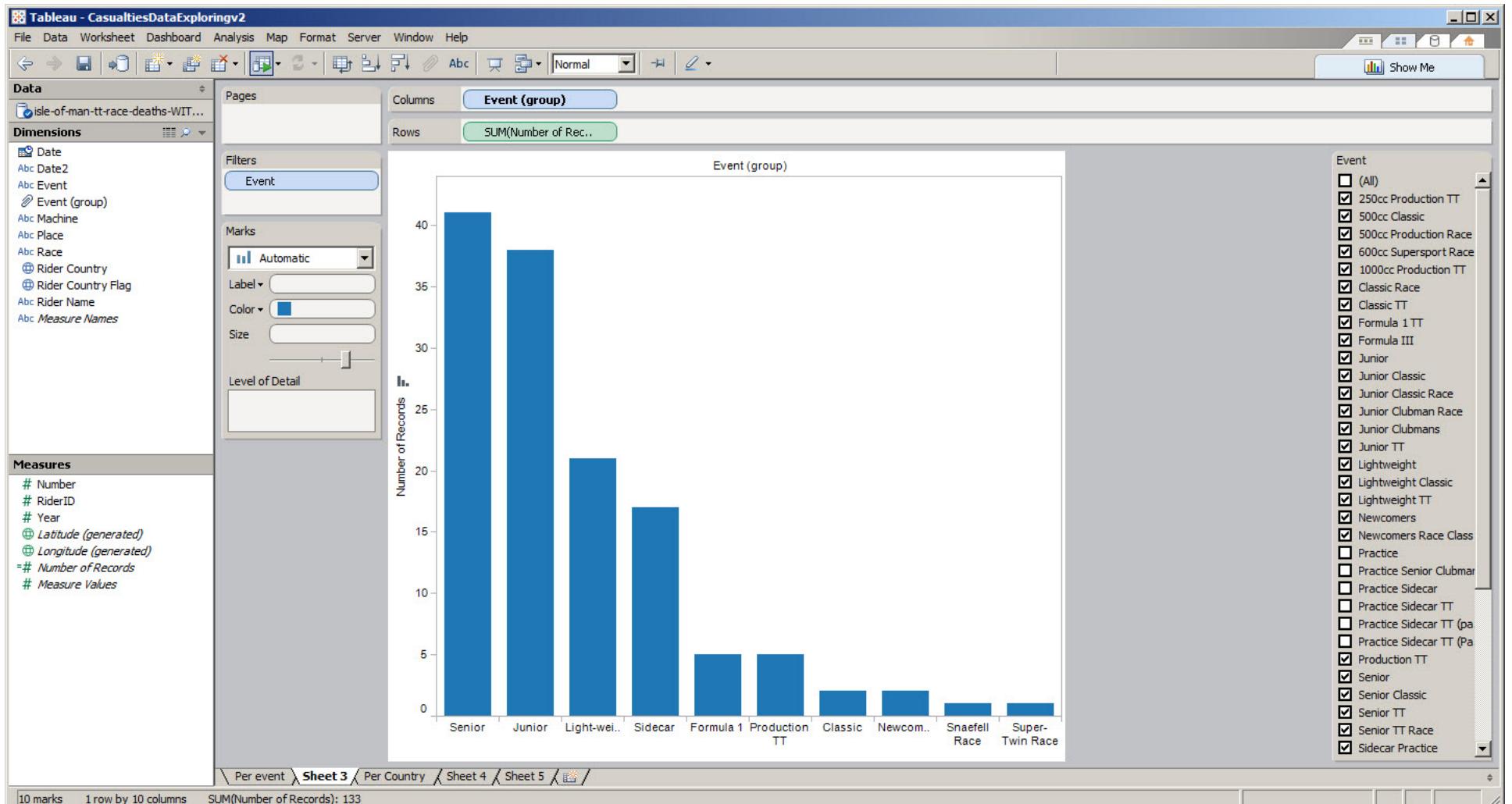
1. a CSV we scraped from the Isle of Man TT Database of all race summary data from 1991-present (used to construct the individual race lines in the primary visualization, as well as aggregate information for the lower rider detail visualization)
2. a CSV we scraped from the Isle of Man TT Database for all rider profile information, including biographies, pictures, and aggregate totals for race position finishes (used for the rider detail panel on the right)

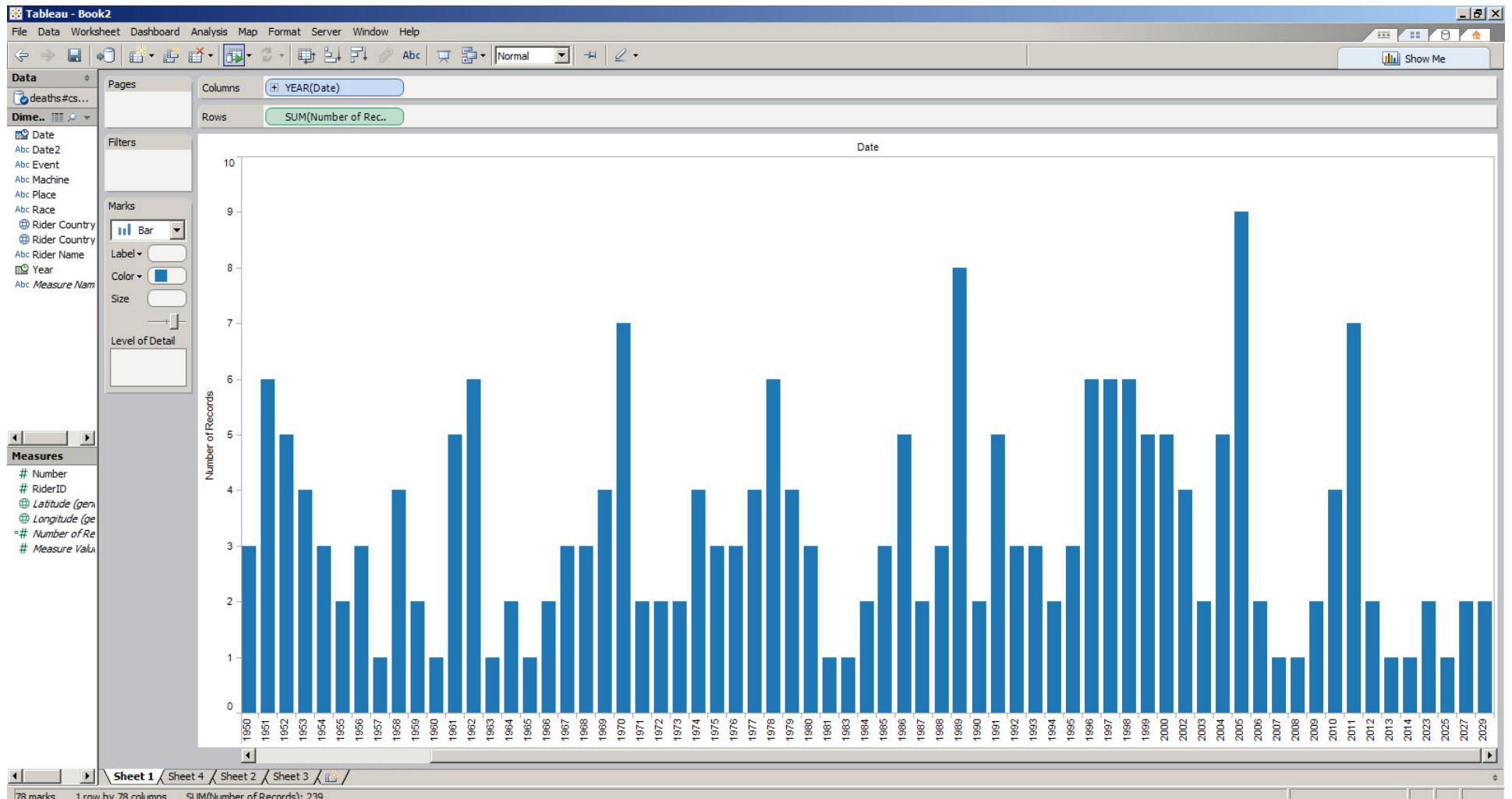
In order to get new information about rider casualty statistics and discover some suggestions we could offer for ways to make the race safer, we also created and used a third CSV datasource containing information on riders that have died during the Isle of Man TT. Our datasource for this CSV was [Wikipedia - List of Snaefell Mountain Course fatal accidents](#), and we constructed the CSV by scraping the Wikipedia page using a Python script.

Here are some screenshots from our early data exploration in Tableau of the new rider casualty CSV:

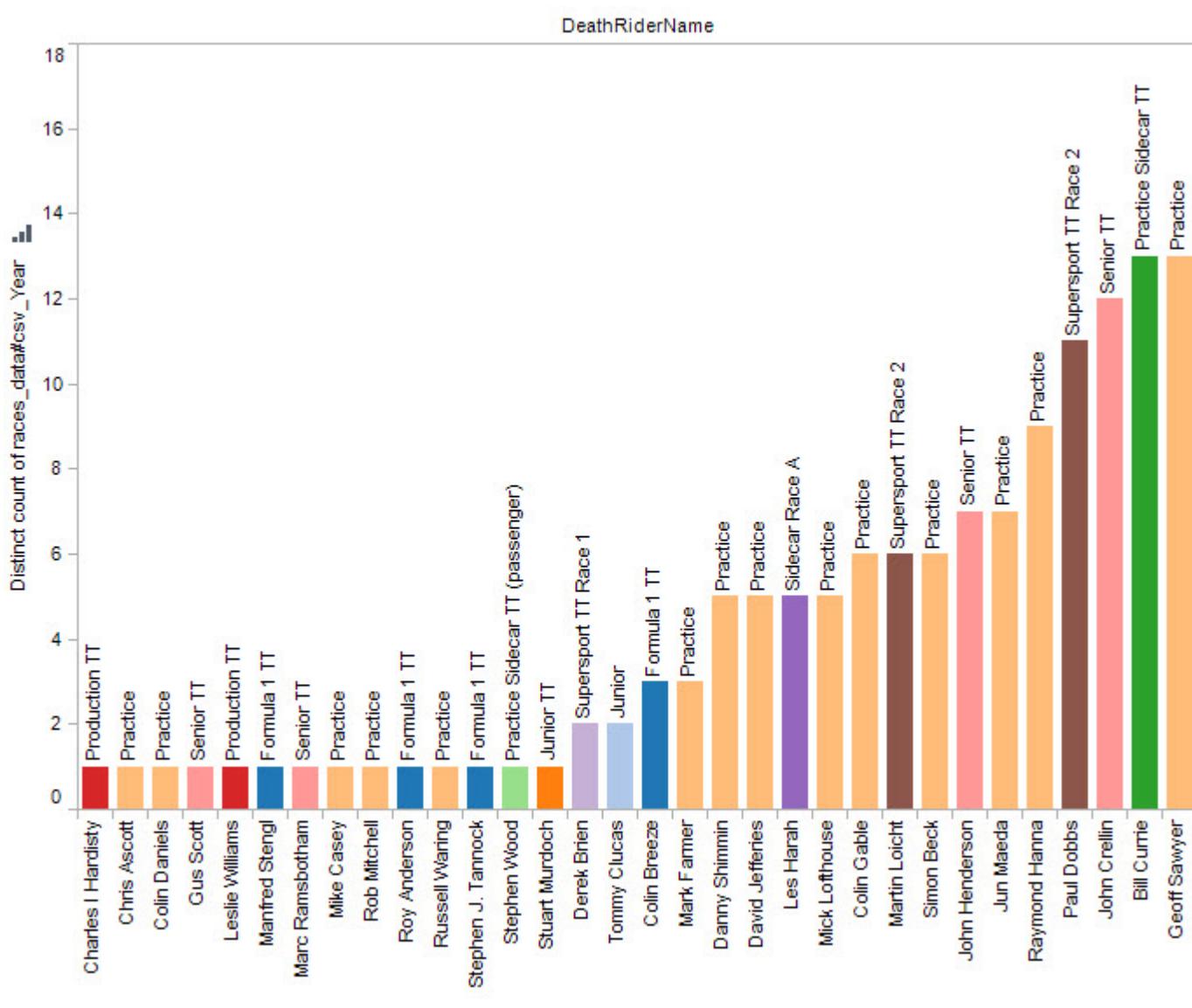


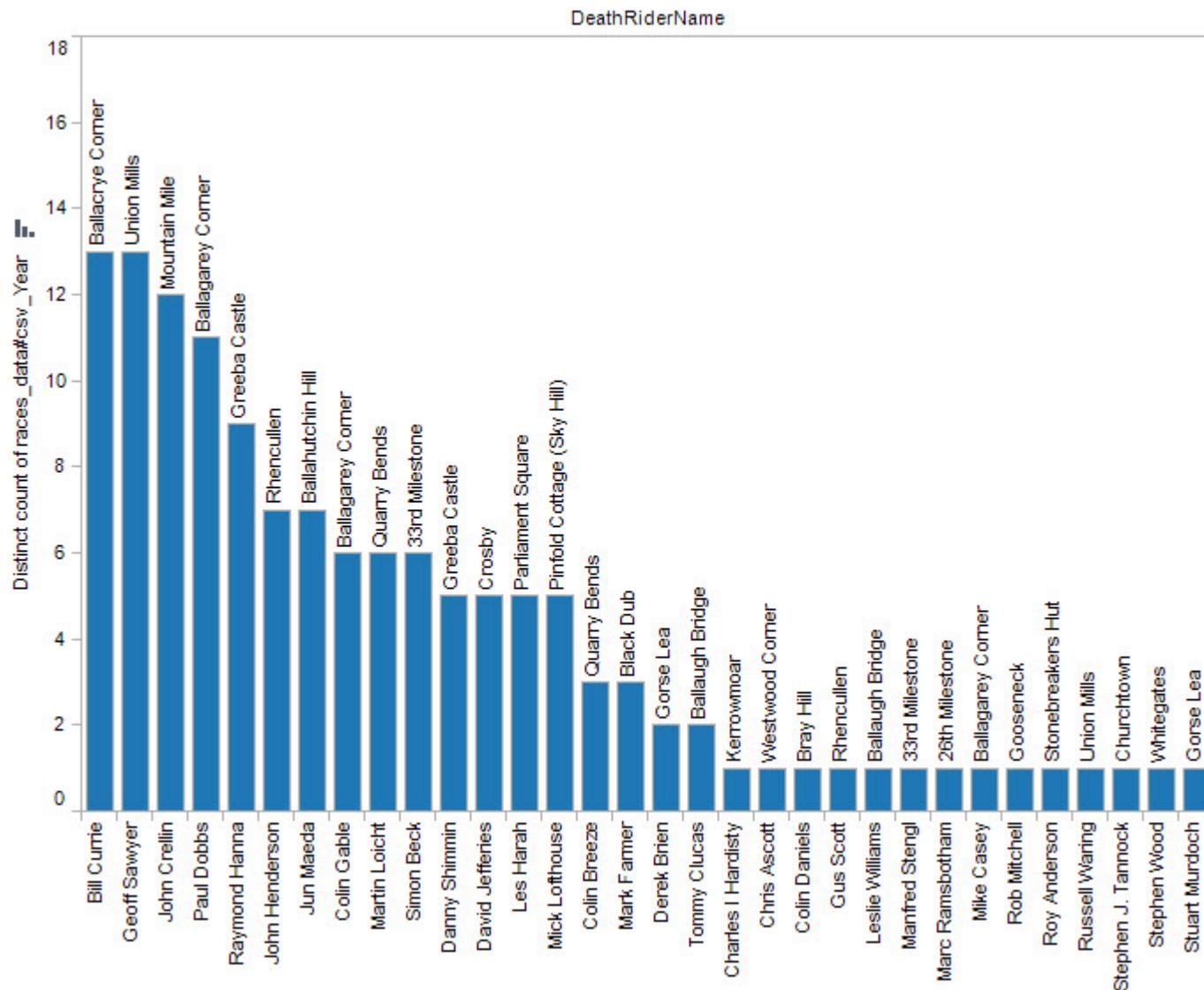
This shows rider deaths by race class – clearly, the overwhelming majority of rider that died did so during practice runs. We also did an alternate version of this graph that grouped the various race classes by their type, and omitted the practice sessions; this shows that outside of Practice race sessions, the Senior and Junior TT race classes have the largest number of rider casualties. This is unsurprising given than the Senior and Junior TT races are the most prestigious, garner the largest number of potential competitor applications, and also race the bikes with the largest engines and are thus the fastest bikes racing on the course.





This graph shows rider deaths by year – we ultimately decided against using any of the year based data in our visualization on casualties because our goals (making enhanced safety recommendations) was not well served by only year-based casualty data.



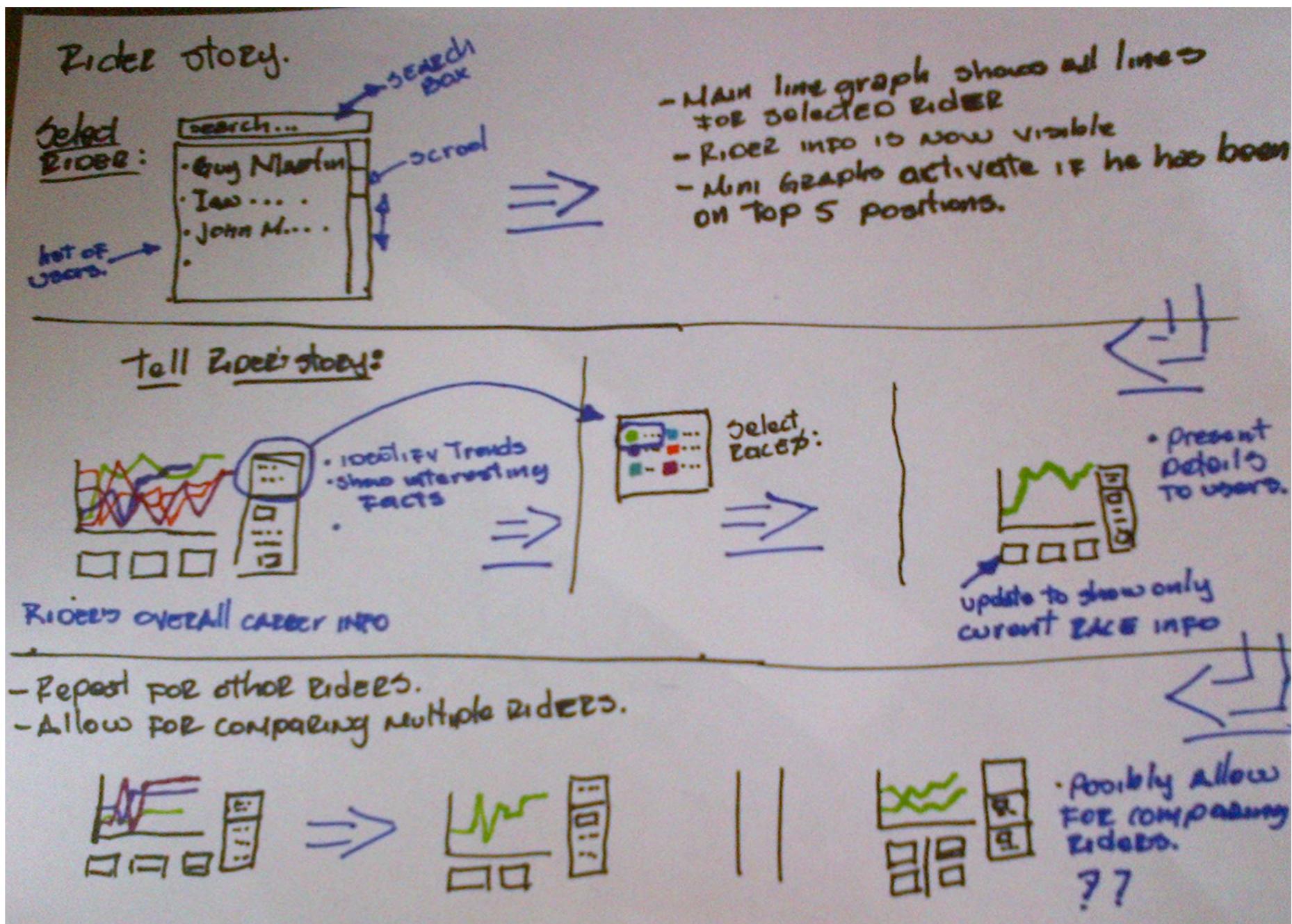


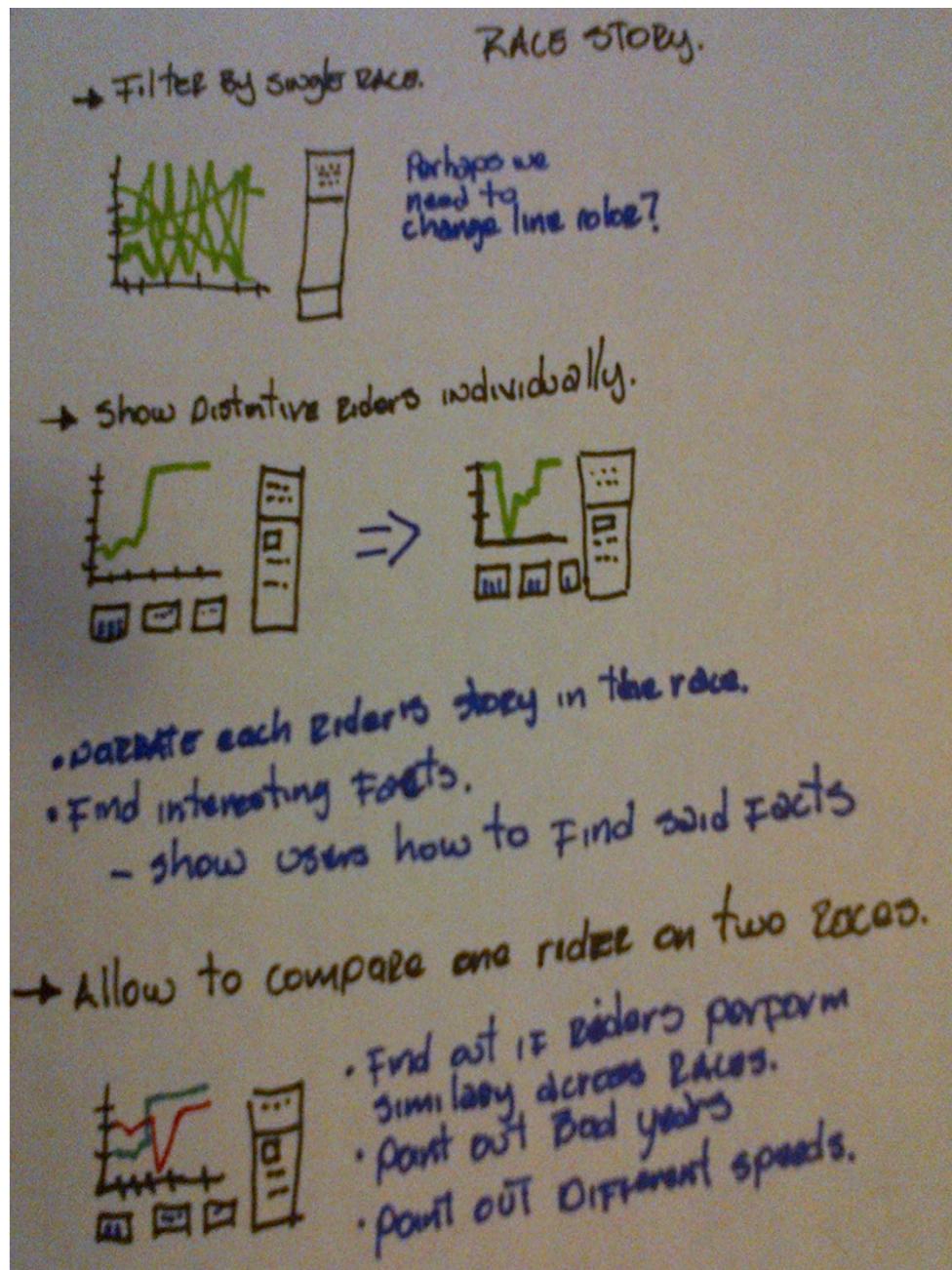
## 4. Storytelling & Early Designs

After meeting with our TF to review our [final Project III proposal](#), we found several different things that we wanted to improve from our Project II submission, including:

- Improved overall webpage layout
- Retain the rider detail panel and lower graphs that users see when mousing over a race line when the user clicks on that race line
- Improved filtering of race classes (add the ability to have N-race classes selected, and turn individual race classes on/off)
- Add tooltips to the rider race line performance so the viewer knows which rider they are looking at
- Add more filtering options for the race classes (our Project II submission only allowed you to view a single race class at a time or view all race classes at once)
- Experiment with different colors (some colors we used in our Project II submission were considered “harsh”)

Here are some sketches we did for Project III that we thought we might use to create our visualization and answer those questions:



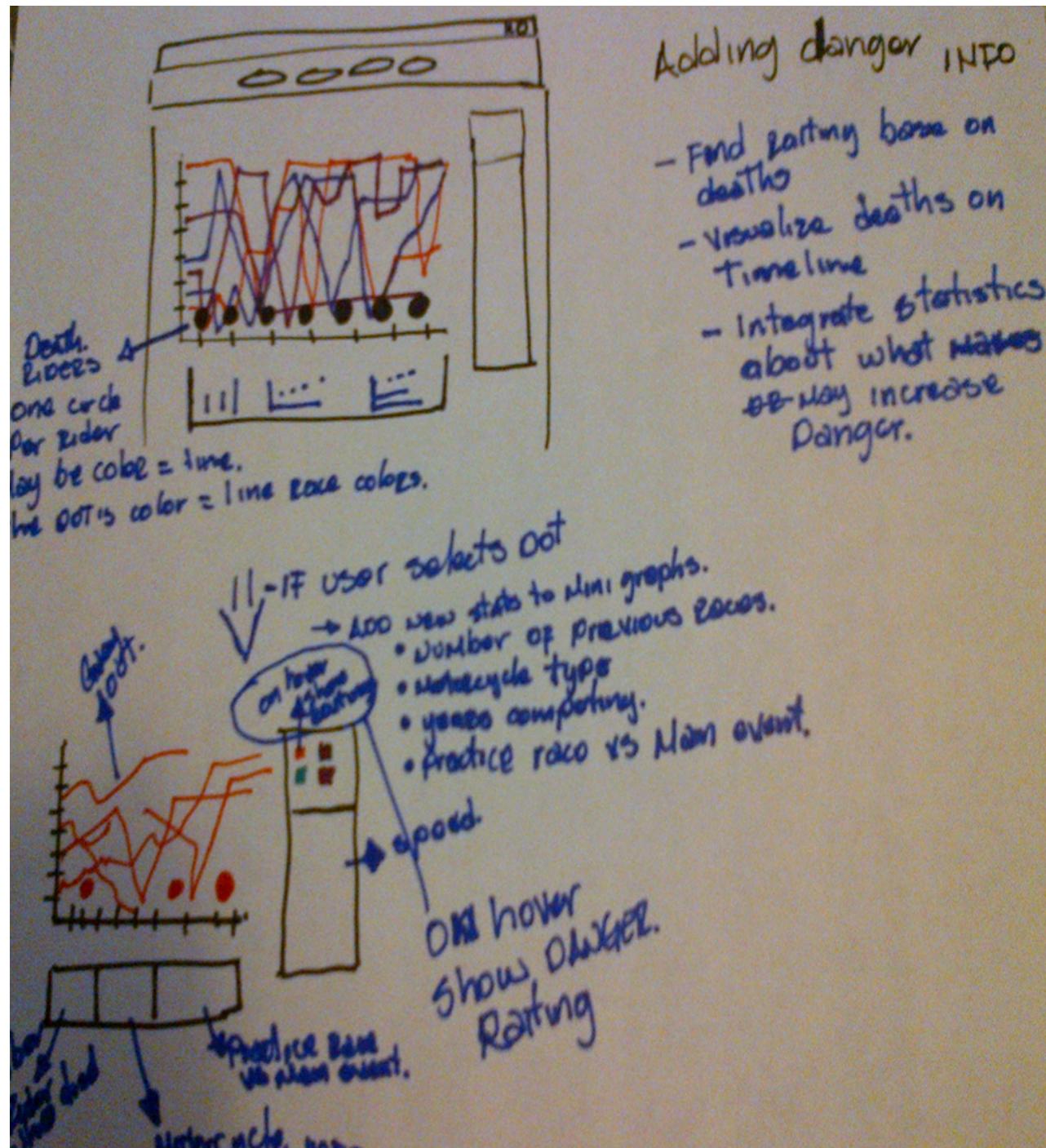


With this sketch we wanted to explore how we could add filtering by race class to our visualization, as well as a way to show individual rider race history; both of these things were items that our TF called out to us during our meeting as things we should improve for this project.

We also showing in these sketches that we wanted to incorporate a way to compare a rider's race class performance history with those of other riders.

Another dimension we considered with our visualization was the ways that we could visualize rider fatalities, in the hopes of coming up with some observations and suggestions for ways to improve the race and potentially reduce the number of fatalities that occur. We initially considered displaying the individual rider race performance history lines with a terminating dot at the end for when a rider died, but ultimately we decided against doing this for a number of reasons, including a technical one – the data source we were using ([Wikipedia - List of Snaefell Mountain Course fatal accidents](#)) did not provide enough information to link a rider's passing with a particular race class in a given year.

On the next page you can see a concept sketch of what we thought such a visualization would look like:



With regards to letting our visualization tell a story, we felt that the improvements we made to the usability of our visualization (e.g., letting the viewer click on a rider race line and keep the rider detail panel on the right and the lower graphs present) would thereby allow the viewer to continue to mouse over other rider race lines, and visually compare how one rider has progressed versus another rider.

Originally we were also planning on incorporating a set of visualizations that displayed aggregate data on rider casualties, with the goal of making some insightful suggestions and recommendations of ways that the Isle of Man TT could be modified to improve rider safety while still retaining the “proud and independent” spirit of the race. We set out a goal of showing three distinct visualizations based on the rider casualty data we scraped:

1. A graph detailing number of rider deaths based on years of experience riding at the TT
2. A graph showing the number of rider deaths by race class
3. A graph showing the frequency of rider deaths at particular locations on the course

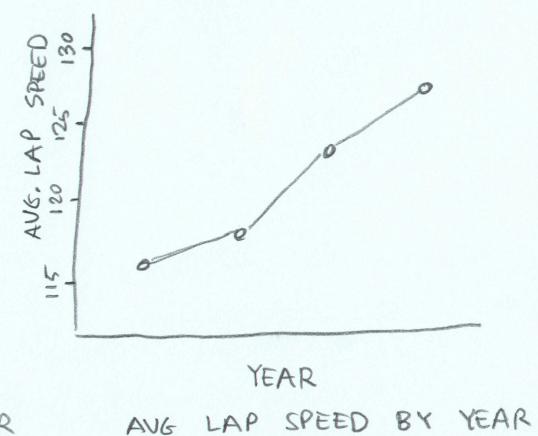
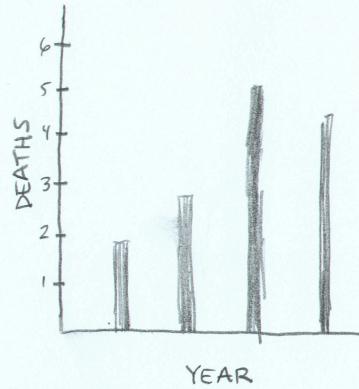
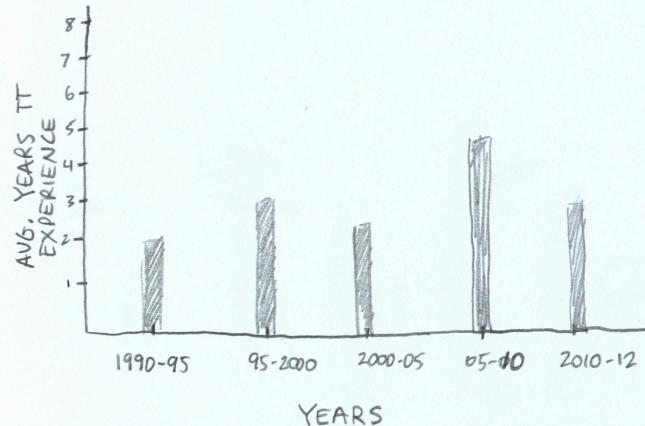
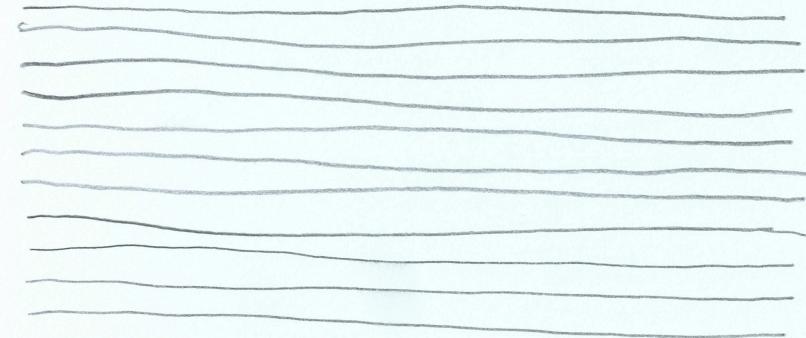
The goal of these graphs was to persuade the viewer that there are sensible measures that the Isle of Man TT race officials could take in order to enhance rider safety. For example, seeing that riders with less experience die in far greater numbers than those with more experience would lead one to believe that a good idea could be to enforce a rule that riders may only race in the lower classes (smaller bike engines, slightly lower top speeds, fewer laps, etc.) for a few years before being allowed to race in the “big boys” race classes such as the Junior TT (bike engine sizes 600cc – 850cc) and the Senior TT (bike engine sizes 850cc – 1000cc). Also, for the locations along the circuit that have the highest occurrences of rider deaths, investigating common-sense ideas to improve rider safety at those locations would be ideal (for example, place tire rack guards along the walls of the course at those locations, widen the track at those locations, re-pave the road in those spots, etc.)

Our intention was to construct a storytelling narrative around these three graphs, and then to have them “lead into” the primary visualization of rider race history performance. Here is a sketch of what we thought that might look like:



# PRESERVE THE TT WHILE SAVING LIVES

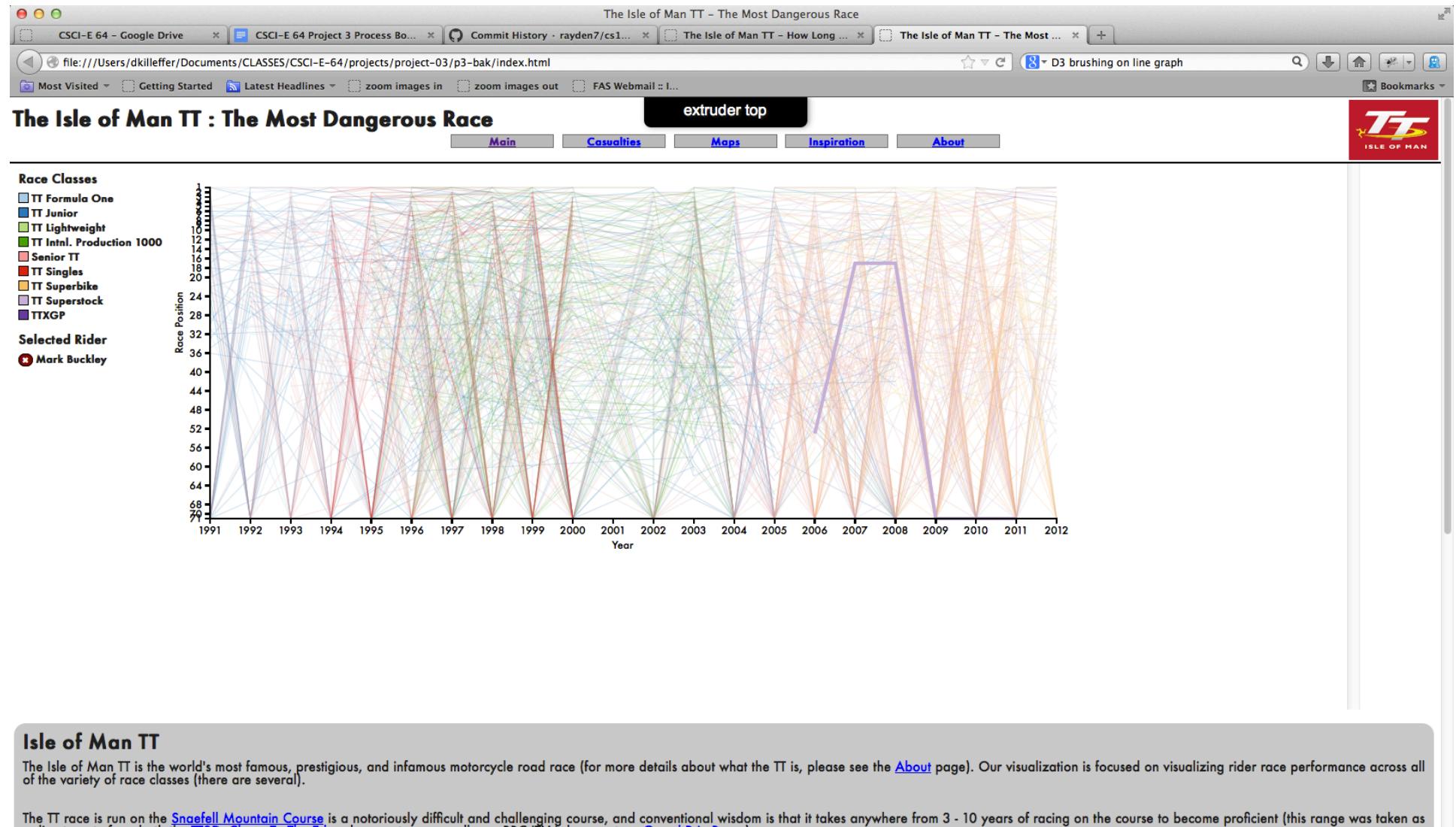
How can the spirit of the race be kept pure while reducing injuries?

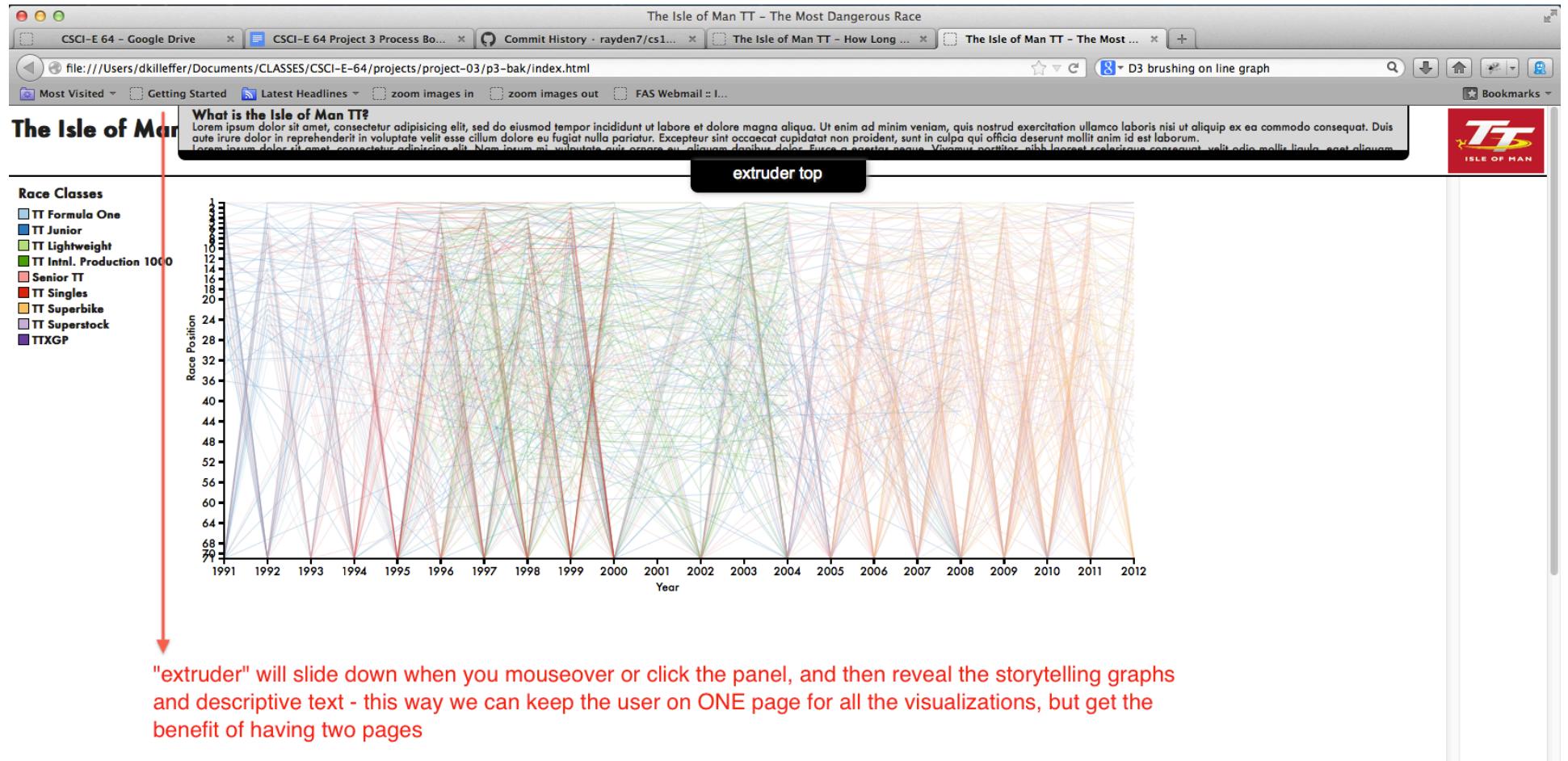


MAIN VIZ FROM P2 BELOW



We also wanted to somehow integrate this new “storytelling” part of our visualization with the primary visualization that shows rider performance over time, but keep the viewer “close” to both visualizations. After several rounds of design and experimentation, we came up with a plan to have a sliding panel show up on the main page that the viewer could select (either by mousing over it or by clicking its handle) and then having that sliding panel animate downwards over the primary visualization. We thought this would be a nice way to show several visualizations presenting evidence backing up our safety suggestions, while keeping the users close to the main visualization. This is what we had intended it to look like (the screenshots show in succession the state of the sliding panel, from initially closed, to partway open, to fully extended):

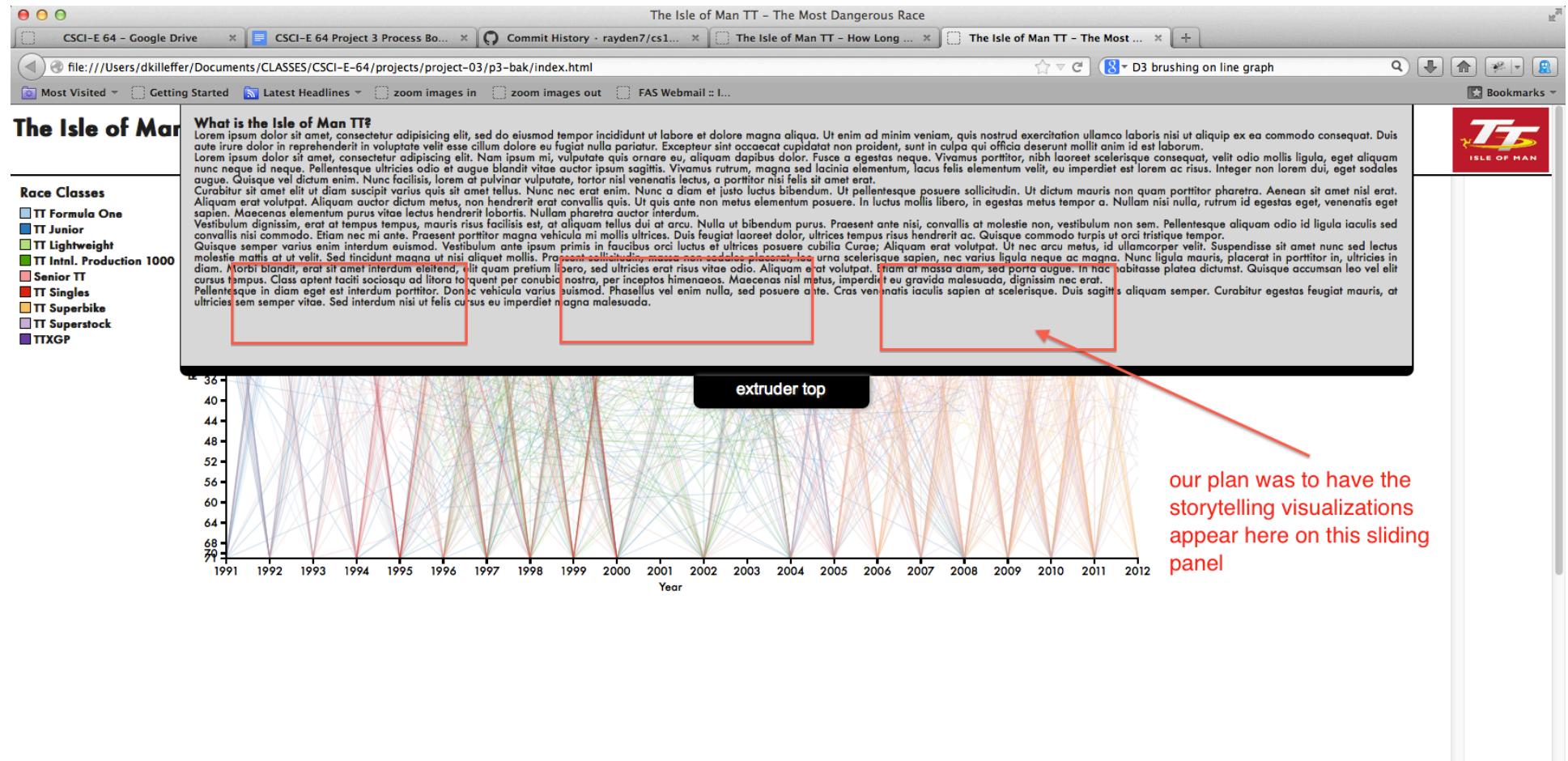




### Isle of Man TT

The Isle of Man TT is the world's most famous, prestigious, and infamous motorcycle road race (for more details about what the TT is, please see the [About](#) page). Our visualization is focused on visualizing rider race performance across all of the variety of race classes (there are several).

The TT race is run on the [Snaefell Mountain Course](#) is a notoriously difficult and challenging course, and conventional wisdom is that it takes anywhere from 3 - 10 years of racing on the course to become proficient (this range was taken as a direct quote from both the [TT3D: Closer To The Edge](#) documentary, as well as a BBC TV documentary [Grand Prix Racer](#)).



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Unfortunately, ultimately we had to abandon this idea because there were incompatibilities with the JavaScript library we were using for the slider ([mb.extruder](#)) and the other JavaScript libraries we used for this visualization (D3, jQuery, etc.).

## 5. Iterative Improvements

We made several changes to our visualization as a result of our TF feedback, as well as implementing several of the same features (ones we had wanted to implement for Project II but did not have enough time). Some of the improvements we made to our Project III visualization over our Project II submission include:

### Enhanced storytelling aspects with a newly added dataset on rider casualties

We scraped Isle of Man TT rider casualties from the Wikipedia page listing them and incorporated the data into our datasets, and created new visualizations delving into the rider casualty statistics. Additionally, the race performance data had its storytelling aspects improved because we now allow for comparison between different riders.

### Improved rider race performance comparisons

Now when you click on a rider race line, the rider detail panel that appears to the right will stay in place, and so will the lower visualizations. The race line you clicked will retain its moused-over state, and then you can continue to mouse over the rider race lines of other racers, and see how their performance compares to the performance of the rider you've already clicked.

### Improved Race Class Filtering

In our Project II submission, you could only filter and display a single discrete race class at a time (so you could not compare rider performance easily across 2+ different race classes), or show all races (rather “noisy”). We modified our Project III so that you can now show an arbitrary number of race classes and filter any way you like – you also get visual feedback on which race classes are shown (the race class appears darker if shown, and lighter if not shown). Also, now none of the filtering options requires a page refresh to get back to all race classes (as it had in our Project II submission).

### Better Usage of Color

Per our TF's recommendation, we revisited our color choices, and opted for a more "pastel" like, lighter color palette for the race classes, as well as for the overall design (opting for a simpler, cleaner look just using a white background). We found that the white background worked best for the visualization because it allowed the best differentiation (we experimented with slightly grey colored backgrounds for the rider detail panel, as well as for the column where the race class filtering was appearing, and the background made the race class boxes appear to be a slightly different color than the actual race lines in the visualization – when we made the entire background white, things visually appeared more correlated). Another major improvement was to change the mouseover lines from being black to retaining their race class color – this way you can better see what race class the line is for, as well as compare it to other race classes.

### Improved Layout, Look & Feel Enhancements

We strove to take to heart our TF's recommendations on improving the layout and color choices, and we did several things, including adjusting the spacing and sizing of the graphs and layout. We also adopted the "Futura" font (the same one used in this process book) to enhance the look as well. We moved all the filtering options (on race class, and also on the currently selected rider) over to a left-hand panel, and reserved the entire right hand panel column for the rider detail info. We also tightened up the overall primary visualization so that we can show more on a smaller resolution screen than previously.

### Use of Tooltips to Explain Details

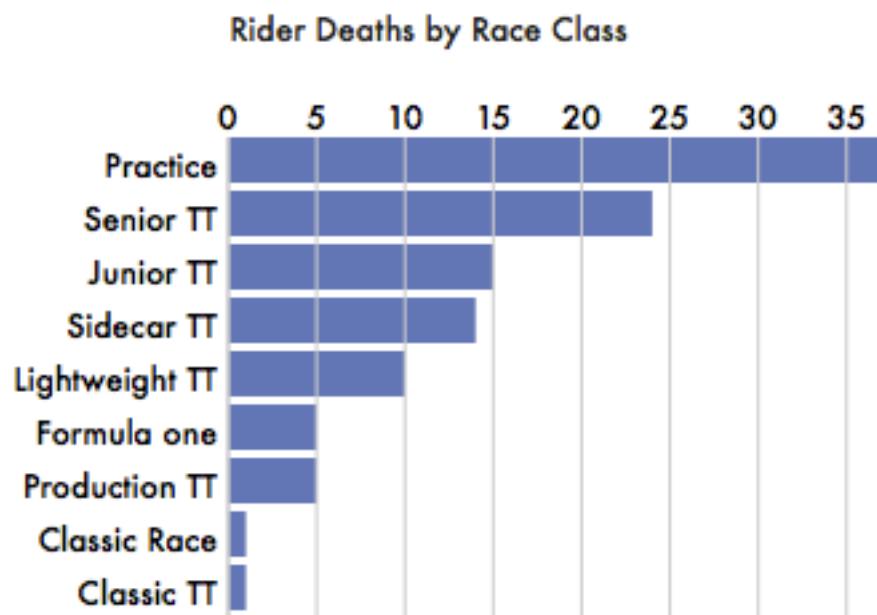
We added tooltips to explain what each race class is, how they are different from one another, as well as incorporate some statistical data on each one (fastest lap in class, who rode the fastest lap, etc.). We also added tooltips to the rider race lines (so you can tell quickly who the rider is, and what race class the line belongs to), as well as to the lower visualizations to indicate rider speed, race position, etc.

Finally, to see several of our back-and-forth changes, how the project progressed, and also look at the delta between our Project II submission and our Project III submission, please see both our GitHub repositories which contain all our code:

- Project II GitHub repo: <https://github.com/rayden7/cs171-project02>
- Project III GitHub repo: <https://github.com/rayden7/cs171-project03>

## 6. Observations & Conclusions

On our Casualties page we investigated the ugly side of the Isle of Man TT races - the tragic loss of life. To date 239 riders have their lives in competitive racing at the Isle of Man TT. One of our goals for this project was to learn more about what the circumstances were surrounding these rider's deaths from the data and to come up with some sensible suggestions for ways the Isle of Man TT race officials can make improvements (both regulatory changes and practical changes) that will enhance the safety of all competitors at the race.

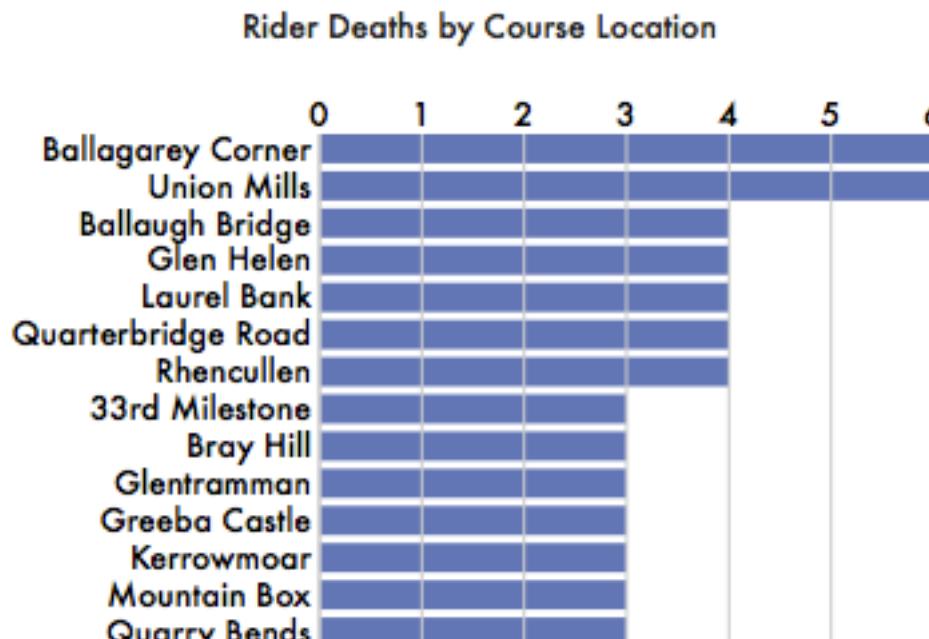


There are a few interesting observations to be drawn from this chart. The first is that the most deaths at the Isle of Man TT occur during **Practice** races, not even during the actual events themselves. This speaks to the inexperience of some riders, as well as the need to better structure the Practice sessions (e.g., more race stewards being available for faster rider assistance in Practice sessions in the event of a crash, etc.). Following the Practice race class, the Senior TT and Junior TT come in at positions 2 and 3 respectively for the largest number of rider deaths, followed very closely with the Sidecar TT. This is unsurprising as the Senior TT and Junior TT typically ride bikes with the largest engines, most cylinders, and highest horsepower and speed - competitors in those races regularly set lap time speed records because the motorcycles they race are machines tuned to the epitome of

motorsport capability. Sidecar TT is also an extremely difficult and dangerous class because it involves two riders; one taking the role of throttle control and part of the steering job, with the riding partner responsible for literally leaning his or her body all the way to the ground across the entire body of the bike to keep the bike on track when negotiating a corner.

Based on these observations, we would make the following recommendations to improve the safety of the TT:

- Enforce a rule whereby competitors must first prove themselves capable and sufficiently proficient in lower-speed race classes (such as Lightweight and Ultra-lightweight) for a period of several years of competition before allowing them to compete in the most dangerous classes (Senior TT, Junior TT, Sidecar)**



In the bottom-left hand corner chart, we can see the frequency of rider deaths by course location. The Snaefell Mountain Course is actually simply a connection of ancient country roads along the Isle of Man, where farmers and tradesmen would frequently travel. As such, the roads are extremely narrow, often tree-lined, and there are many stone walls lining large portions of the course that demarcate property borders of farmers and ranchers.

The course has always been fraught with danger, but we recommend the following common-sense changes be made to improve the safety of these most-dangerous portions of the track:

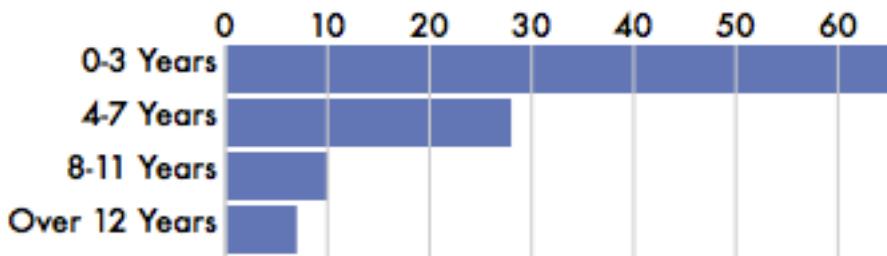
- Add barrier walls made of tires or other equivalent density materials along the brick walled course borders at all locations from Ballagarey Corner through Rhencullen**

- ***Investigate options for widening the circuit track along the corners at those locations***
- ***Employ additional race stewards and medical personnel at those locations***

Finally, in the chart on the right hand side, we show perhaps the most interesting chart of all - rider casualties based on years of experience racing in the Isle of Man TT races.

Riders with experience ranging from their very first TT race to three years of TT racing had the overwhelming majority of the number of deaths. There seems to be quite a drop-off in the likelihood of rider death occurrences once a rider has reached 7 or more years of experience.

Rider Deaths by Years of Experience at TT



Based on this chart, we recommend the following:

- ***Enforce all riders to provide repeated, demonstrated competitive experience at other similar caliber motorcycle road racing circuits (such as the Northwest 200 or Southwest 100 road races in Ireland, etc.) before allowing them to compete at the Isle of Man TT***