

Analysis of FRC Team Distribution and District Implementation in New York State

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Disclaimer: This is by no means an official proposal. Rather it is a compilation of extensive research, findings, and suggestions that the FIRST community in New York State may find useful.

Overview

Based on the discussion in [this ChiefDelphi thread](#), an apparent need for in depth data analysis, and my personal curiosity related to the topic I decided to take a closer look at the potential implementation of a District Competition Model for FRC in New York State. Mainly, I've focused on analysis of the geographic team distribution across the state and the common contention related to the District Championship location to gain a stronger understanding of how a reasonable District Competition structure may look in New York State, assuming the state would attempt to go to the District Competition Model as a whole.

The District Competition Model

Prior to applying the District Competition Model to New York, it is foremost important to understand at a fundamental level what goals the District Model initially intended to achieve, why these goals were set, the environment in which the model was developed, and the history of the district model in FRC. Based on my reading of [this ChiefDelphi thread](#) from 2008 and [the corresponding announcement released by FIRST](#), the District Competition Model was announced in the summer of 2008 to take effect in Michigan starting with the 2009 season. In the 2008 season, Michigan held 3 traditional Regional Competitions with a total of 148 slots to accommodate 118 teams in their state. This is a 1.25:1 ratio of slots available to number of teams. Due to factors like teams from other states also competing in Michigan and the desire by some teams to play in more than one event, it was recognized that additional team growth in the state of Michigan would soon require an additional Regional Competition. Furthermore, the economic climate of that time put financial stress on FRC teams and Regionals, especially in Michigan where the strength of the economy is heavily reliant on the automobile industry. These factors combined to prompt a change in competition structure with goals of developing a scalable model which accommodates team growth, consists of more cost-effective competitions, and increases the return on investment (ROI) for teams.

In the 2009 FRC season, FIRST in Michigan (FiM) piloted the District Competition Model with 133 teams competing in 7 district competitions of about 40 teams each and a State Championship with 64 teams competing. The pilot system was evaluated in [this study](#), and a nearly identical model has been used there ever since. 346 Michigan teams competed in 18 district competitions and a 102 team State Championship in Michigan during the 2015 FRC season, demonstrating that this model can successfully manage FRC team growth within a state.

In the District Competition Model, teams receive slots at 2 district events of approximately 40 teams each for their \$5000 registration fee. At these competitions, each team plays 12 qualifying matches over 2 days, in contrast to Regionals where teams play a variable number of qualifying matches over 3 days. Performance criteria are used to rank teams throughout the season, and a portion of teams are invited to participate in the District Championship at a cost of \$4000 based on their season performance and Culture Changing awards. Advancement to the "World" Championship is similarly determined using the points and awards to determine who qualifies. [Here](#) is a summary of the Standard District Points Ranking System in FRC used in the 2015 season.

In the 2015 season there were 5 regions competing in FRC under the District Competition Model: Michigan, Mid-Atlantic (NJ, DE, eastern PA), New England (MA, CT, ME, NH, RI, VT), Pacific Northwest (OR, WA), and Indiana. I've researched historical data on each of these Districts and presented it [here](#). Of particular interest to New York is the startling growth of FRC in Michigan, the

similar size of the NE and PNW regions to NYS as measured by team count, the similar size of IN to upstate NY by team count, and the similar size of MAR to downstate NY by team count. These provide insightful examples for the potential implementation of the District Competition Model in New York and are a testament to the model's flexibility. However, it is important to properly apply the District Competition Model to a new region to allow the region and its teams to succeed and thrive.

The State of FRC in New York State

I have done an extensive geographical analysis of the 2015 team distribution in New York State, presented [here](#) using data from thebluealliance.com and usfirst.org. Honestly, it doesn't tell us much that we didn't already know about the team distribution: there is a clear divide between upstate and downstate team populations. Upstate New York consists of 29 teams from Western New York, 12 teams from Central New York, and 10 teams from the Capitol District for a total of 51 teams. Downstate New York consists of 49 teams from New York City and 47 teams from Long Island for a total of 96 teams.

There are currently four FRC Regional Competitions hosted in New York. The two upstate Regionals are the Finger Lakes Regional in Rochester, NY and the Tech Valley Regional in Troy, NY. These events hosted a total of 81 slots in the 2015 season, which accommodates at least 1 event for all 51 upstate teams, allowing many to attend two events if they wish and for some room to grow. The two downstate Regionals are the New York City Regional in New York City and the SBPLI Long Island Regional in Hempstead, NY. These events hosted a total of 117 slots in the 2015 season, which at a 1.22:1 ratio of slots available to teams restricts the number of local events available to almost all downstate teams to 1 per team. This creates less opportunities for teams to play than teams in Michigan had in 2008, when they chose to adopt the District Competition Model.

International teams comprised 9 of the teams attending the New York City Regional in 2015 and 3 of the teams attending the Long Island Regional, which leaves only 105 slots for the 96 downstate teams. This makes objective of welcoming international teams and offering every downstate team a local event stressful on the system as a whole, and it presents a limit to the growth of FRC in downstate New York. Additionally teams at the New York City Regional only played 8 qualifying matches, which is a very low ROI in comparison to that experienced by upstate teams or teams in districts.

It is clear through this lens that expansion of the number of events offered in downstate New York is an imminent need to accommodate the growth of FRC in New York State. If this route is necessary, why not do so in a way that generally improves teams' ROI? These pressures are very similar to those experienced by FRC teams and Regionals in Michigan in the 2008 season which led to the adoption of the District Competition Model discussed above. In fact, the ROI argument alone has merit to drive some regions to adopt such a model regardless of team growth/capacity constraints.

One reason NOT to adopt a District Competition Model would be that it is not necessarily a Pareto efficient change, meaning that ALL stakeholders do not experience benefit (or at least neutral effects) from the change. With each aspect of any proposed District Competition Model, it is important to thoroughly consider the different stakeholders and how the change will affect them. As such, we shall consider the following stakeholders, and how a proposed District Competition Model for New York State as a whole would likely impact them. These stakeholders will include: New York City (NYC) teams, Long Island (LI) teams, Western New York (WNY) teams, Central New York (CNY) teams, Capitol District (CD) teams, International teams, volunteers, and the various prospective district event

planning committees. This analysis looks most closely at the teams and also takes into account local preparedness to host events.

Prospective District Event Geographical Allocation

Based on the geographical split of teams, the necessary number of downstate districts could reasonably be assumed to accommodate downstate teams and the same method could be applied for the number of upstate districts. Assuming 40 teams per district event, 5-6 district events would be necessary to support the 96 downstate teams and 3 district events would be necessary to support the 51 upstate teams.

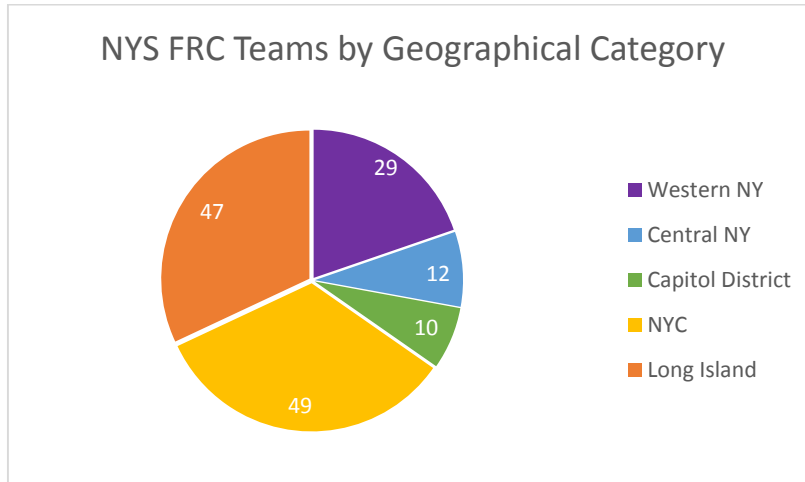


Figure 1: Graphical representation of FRC team location break down in New York State.



Figure 2: Map of New York State with FRC team locations over laid as orange dots.

Given the approximately equal distribution of downstate teams between NYC and LI at present (49 vs. 47) and the possibility of growth between now and the implementation of a prospective District Competition Model, it would be reasonable to suggest 3 NYC districts and 3 LI districts as an effective allocation of district events, with the aim of providing 2 local district events for all teams in downstate New York. A few suggestions for integrating International teams into a prospective New York State District Competition Model are discussed below.

The district competition allocation for upstate New York is recognizably trickier. There are 2 locations with a cluster of teams: 29 teams in Western New York, mostly within an hour drive of Rochester, and 10 teams in the Capitol District, mostly within an hour drive of Albany. There are additionally 12 CNY teams sparsely located throughout the state. With 3 district competitions to locate, it is a clear decision to put one district in the Rochester area and one district in the Albany area. Each of these is near one of the clusters of teams and they are geographically located at either end of the state to offer almost all teams at least one tournament within 2 hours of driving distance.

However, the location of the third district is less obvious. 3 locations have merit: Syracuse, Binghamton, and another event in the Rochester area. Syracuse and Binghamton would result in less travelling distance for CNY and CD teams to attend this district, but almost all of the teams attending events in either of these locations would require hotel stays. A second event in Rochester would be necessary to provide 2 local plays for all 29 of the WNY teams, but would require farther travel distances for CNY and CD teams. However, one consideration that a second Rochester event trumps a Central New York event in is the minimization of necessary hotels due to the number of teams within a reasonable distance to avoid hotel stays. Therefore, 2 events in the Rochester area and 1 event in the Capitol District is a reasonable allocation of upstate New York district events in a prospective New York District Competition Model. However, there is merit to considering 1 Rochester area event, 1 Capitol District event, and 1 Central New York event as an allocation of district events in New York State. In either case, the eventual fourth upstate district event “on deck” would be the extra event from the alternative case.

Other locations besides those specifically suggested (e.g. Buffalo, Ithaca, etc.) may also be preferable depending on factors like local support and venue availability. Additionally, it is noteworthy that both the New England and Pacific Northwest districts host more district events than the number of teams would dictate at 40 teams per district event, most likely with the objective of bringing events closer to teams. This may also be considered to bring more events closer to teams in upstate New York, but would also require putting on more events, meaning more resources to do so.

District Championship Location

This was the most insightful portion of the exercise and also the most time consuming. The longitude/latitude coordinates (using google maps), the closest mile marker on the NYS Thruway as a linear coordinate system for teams in the State (using [this document](#)), and driving distances to each of 4 commonly proposed District Championship locations (NYC, Albany, Syracuse, and Binghamton) were recorded for each team in New York State. Objective measures were employed to hopefully gain a more thorough understanding of how the team distribution in the state should influence the District Championship location. These included the center of mass of teams in the state using longitude/latitude data, the average mile marker location along the NYS Thruway for all teams, the sum of all travel distances to each of the four locations, and the sum of the squares of all travel distances to each of the four locations (sum of squares is a commonly used approach in statistical analysis to grant “appropriate” weighting to outliers in a dataset).

The center of mass of all teams in New York State is located about 20 miles west of Newburgh. The average position along the NYS Thruway is between exits 20 and 21, which are the exits for Saugerties/Woodstock and Catskill/Cairo respectively. Neither of these measures are very insightful, as no locations close to these centers of population are suitable for a District Championship Event and neither location is near a large population of teams. Additionally, the linear Thruway measure

introduces error for teams located far away from the Thruway, such as those on Long Island or those significantly north or south of the thruway in upstate New York.

The driving distance metrics were more insightful. The driving distance between each team location and each of the 4 mentioned prospective District Championship locations was recorded from google maps, then tabulated. Overall, New York City minimizes total driving distance for teams. Albany and Binghamton each require about 50% more total travel distance, and Syracuse almost doubles total travel distance as compared to New York City. When looking at the square of travel distances New York City wins out again, with Albany requiring about 6% more total squared travel distance, Binghamton requiring about 16% more total squared travel distance, and Syracuse requiring about 75% more total squared travel distance as compared to New York City.

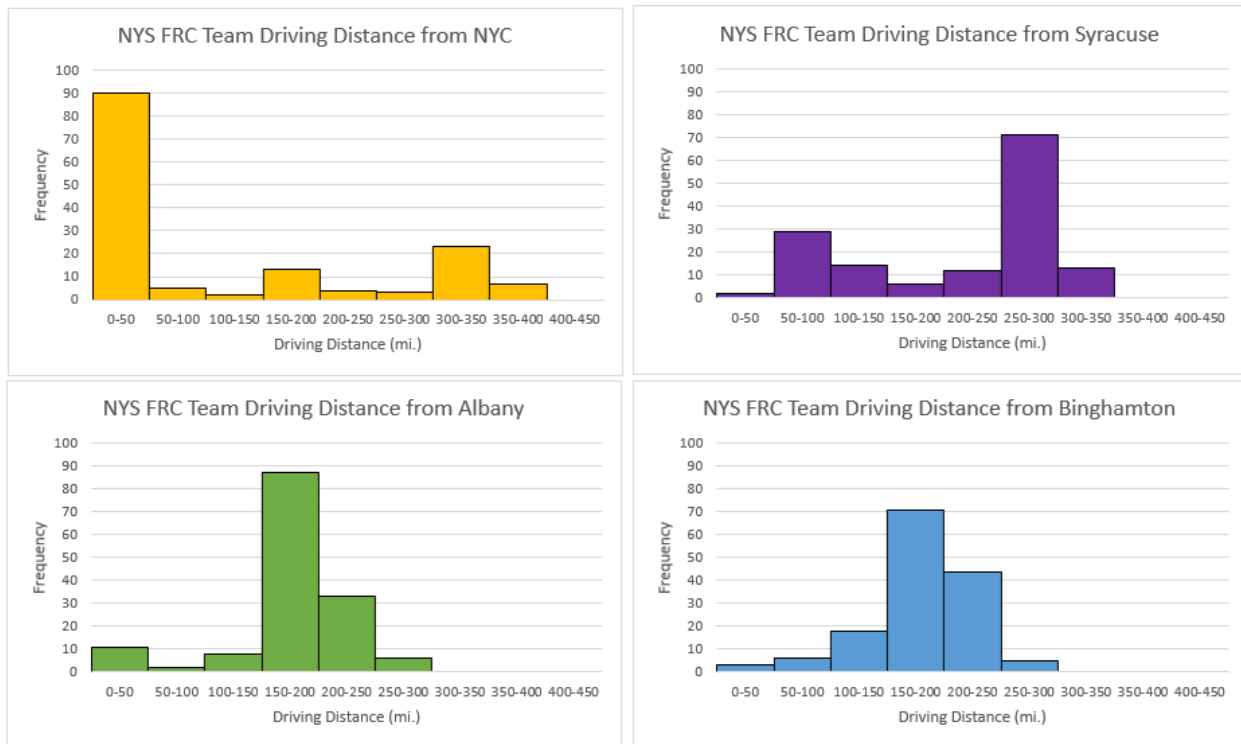


Figure 3: Histograms of New York State FRC team driving distances from each of four commonly suggested District Championship locations: New York City, Albany, Syracuse, and Binghamton.

Admittedly, upon starting this analysis I was reasonably certain that my conclusion would be to put the District Championship in a more “central location” like Albany or Syracuse. However, upon completing this analysis, I now believe that the optimal location for a New York State District Championship would be New York City, with Albany being a reasonably close second, and Syracuse being significantly worse than any of the other options evaluated. Given that there would likely be little crossover between downstate and upstate teams during district event play, it is likely that the team distribution at a District Championship would have roughly 65% downstate teams and 35% upstate teams, or about 22 upstate teams and 42 downstate teams at a District Championship of about 64 teams (which is consistent with historical District data).

With a District Championship in NYC hotel stays would be minimized, and the teams that are generally most familiar with travelling (upstate teams) would be the ones required to make the trip. These are

by no means perfect metrics for determining the location of a District Championship, but they were a best effort given the readily available information and I find them particularly interesting because they shatter my preconceived notions of what makes sense.

Key issues with a District Championship in NYC for upstate teams in particular are the cost of hotels, the cost of food, and difficulty storing a bus. However, I would propose pursuing state funding or statewide corporate sponsorship to subsidize the travel of New York State teams who advance to a District Championship in NYC, similar to [the grants/funding Michigan acquired a few years back](#). Even if we were able to raise something like \$3,000 per upstate team travelling to the District Championship for an approximate total of \$66,000, which is one-fiftieth of the total amount in the Michigan grant, this would drastically improve the feasibility of upstate teams attending a District Championship in NYC. This would be a win-win, with downstate teams getting a District Championship close by and upstate teams who qualify getting a subsidy to make it there. An alternative I had thought of was a similar subsidy for downstate teams to come to Albany for a District Championship, but based on the larger number of downstate teams and the difficulty of travel for many NYC teams, I would have to believe less total funding would be necessary to reasonably get upstate teams into the city. I could be wrong on that though.

Marginal Impact on Stakeholders: Downstate Teams

In transitioning from the traditional Regional Competition Model to a District Competition Model, it is important to consider the marginal influence such a change has on teams and the volunteer organizations that make FRC possible. For this exercise, a District Competition Model with 3 NYC events, 3 LI events, 2 WNY events, and 1 CD event with a District Championship in NYC with subsidized funding for upstate teams who qualify for the District Championship will be considered.

For the 49 NYC teams there would be 3 district events within the city, allowing for at least 2 plays for each of these teams. Additionally, with the District Championship in NYC, this would allow for 2 plays for \$5000 for NYC teams, or 3 plays for \$9000 for NYC teams who qualify for the District Championship, all without leaving the city. The lone drawback for NYC teams who previously only competed in one event in the traditional Regional Competition Model would be the need to pay for an additional competition (the District Championship) before qualifying for the “World” Championship. Previously the difficulties of finding affordable venues for NYC district events has been mentioned, so this is another hurdle that would need to be tackled.

For the 47 LI teams there would be 3 district events on the island, allowing for at least 2 plays for each of these teams. With the District Championship in NYC, most LI teams would not require hotels to compete in this event. 2 plays on LI for \$5000 or 3 plays all downstate for \$9000, all without requiring hotels for most teams is a good deal for LI teams. One drawback for LI teams who previously only competed in one event in the traditional Regional Competition Model would be the need to pay for an additional competition (the District Championship before qualifying for the “World” Championship. While the affordability of venues on LI has not received as much attention as the concerns for affordability in NYC, the lack of an offseason event hosted on LI (to my knowledge after extensive CD and FIRST website searches) indicates that LI may not have the same experience as upstate at hosting smaller, more affordable events.

Marginal Impact on Stakeholders: Upstate Teams

For the 29 WNY teams, the 2 Rochester area district events would allow for all of these teams to have 2 plays without requiring hotels. However, the WNY teams would need to take up to a 6.5 hour trek to make it to the District Championship, hopefully at a subsidized value to make up for the additional costs of going to the city. It is worth noting that some teams in the Michigan and Pacific Northwest Districts travel even farther distances to make it to their District Championships. For WNY teams that currently attend only the Finger Lakes Regional, they would get an additional local tournament for their registration fee. However, if these teams qualify for the District Championship in New York, additional costs would be incurred before having a chance to qualify for the “World” Championship. For WNY teams that attend more than one Regional event, the marginal effect is an additional local competition, with the travel competition in NYC provided that the team qualifies for the District Championship. Additionally, the Rochester area already hosts the offseason event Rah-Cha-Cha Ruckus, proving the ability of the local volunteers to host affordable events.

For the 12 CNY teams, this scenario would have no local events. Many of these teams already attend two events, but requiring 2 district events and a District Championship in NYC would mean 3 long distance events before these teams have an opportunity to qualify for the “World” Championship. It is likely that Syracuse, Binghamton, or Ithaca would be potential locations for additional district locations with further growth in FRC teams upstate, but even then these teams are so sparsely distributed across upstate New York that none of these locations alone would eliminate hotel stays for all of these teams. These teams are the most difficult to accommodate in a transition to the District Competition Model.

For the 10 CD teams, the 1 local district event would provide 1 play without requiring hotels. These teams would need to travel to another event, likely one in WNY (or one in New England if FIRST allows inter-district play to earn teams points) for their second district event. Then they would travel to NYC for the District Championship if they qualify. This means an additional travel event for those CD teams which play only 1 Regional currently or for those who qualify for the District Championship and play in 2 Regional events currently. However, it means 2 additional travel events for teams that currently only compete at the Tech Valley Regional and go on to qualify for the District Championship. Until 2014 though, all of these teams travelled to any competition they competed in, so many are accustomed to multiple travel events per season. The local volunteers began hosting an offseason competition, Tech Valley Robot Rumble, in 2014. This demonstrates that the Capitol District is ready to meet the demands of an affordable, local district competition.

Marginal Impact on Stakeholders: International Teams

A total of 11 teams from outside North America were hosted by New York State Regionals in 2015: 9 at the New York City Regional and 2 at the SBPLI Long Island Regional. Teams from Canada additionally competed in New York Regionals in 2015, but these teams have other competitions closer to home where they can compete. The main focus in accommodating international teams in a District Competition Model in New York State would be those teams without opportunities for local competitions who turn to New York competitions for their FRC experience.

Since 2009, teams from outside the District Competition Model have been unable to compete in events hosted within the District Competition Model. It has been publicly noted that this was not the intent of FIRST in Michigan, but rather a restriction imposed by FIRST for the implementation of the District

Competition Model. In 2015, FIRST began allowing teams from one district to compete in another district for [Inter-District play](#), although not for points. This allows a team from New England to compete in a district event in the Mid-Atlantic or a team from Indiana to compete in a Michigan district in addition to their 2 district events in their home district. However, as more and more regions transition to a District Competition Model within FRC, the current policy by FIRST will limit the options for international teams aiming to compete in FRC.

This restriction is an artificial one imposed by FIRST. We can do better. The downstate New York FRC events are a very attractive and generally reasonable destination for international teams who compete in FRC, so we need not impose artificial barriers to participation. There are a few simple solutions that come to mind for allowing international teams to compete in a prospective New York State District Competition Model, while only requiring that these teams attend 1 competition in New York before qualifying for the “World” Championship. One is reserving a certain portion of slots at the District Championship for teams outside North America that would like to compete in New York. For advancement to the “World” Championship, these teams could either start from 0 points and accumulate points at a 5X multiplier or start from the minimum number of points required to qualify for the District Championship and accumulate points at a 3X multiplier for the District Championship. These teams would then be included in the rankings for teams in New York and qualify for the “World” Championship by points in the same way that all other teams in the state qualify by points or awards.

An alternative would be to allow international teams to sign up for the district events in New York State, and allow for their direct advancement to the “World” Championship by merit if the team is the Captain or 1st selection of the winning alliance or wins the District Chairman’s Award. The Captain and 1st selection of a winning alliance would be likely candidates to qualify by points anyway, and a recipient of FIRST’s major Culture changing award is deserving of an opportunity to continue pursuing that award at the highest level. Any teams that would qualify for the “World” Championship by these means could still count against the District’s slot allocation, but also figure into the proportional calculation for representation at the “World” Championship. These suggestions would each allow for international teams to come compete once in New York with an opportunity to qualify for the “World” Championship all the while without travelling to the states more than once beforehand.

Conclusion

Right now, with 147 teams in New York State, a proportional representation of teams at the “World” Championship would result in an allocation of about 30 teams in 2016 and about 40 teams in the 2017 for District Championship slots. The number of FRC teams in New York State is roughly the same as the number of FRC teams in the Pacific Northwest District Competition Model. A 2017 start date for a District Competition Model in New York would be challenging, but if things got moving soon it could happen.

An alternative that has been mentioned is for upstate New York to go to a District Competition Model on its own while downstate works to find ways to host affordable events practical for districts. An independent district for upstate New York would be roughly the size of the Indiana district piloted in 2015. It has also been mentioned that New York appears “locked out” from other districts around the state, so this means New York should not plan on the ability to “piggy-back” with other districts.

I strongly believe that New York State could feasibly compete in a District Competition Model with 3 NYC district events, 3 LI district Events, 2 Rochester area district events, 1 CD district event, and 1

District Championship in NYC with funding for upstate teams who qualify to attend by 2017. This could be done in a way that accommodates the future growth of FRC in New York State while increasing the return on investment for teams in NYS and knocking down artificial barriers which currently prevent international teams from competing in areas with a District Competition Model.