King County Fire Zone 1
Code 3 Simulator Project

In the Summer of 2016, Eastside Fire and Rescue and Bellevue Fire Department contracted with Coelo Company of Design to purchase their Incident Modeling and Analysis tool “Code 3 Simulator”.

After working for years with another major product, they found Code 3 Simulator to be much simpler to use, less expensive, and capable of producing more robust and dynamic incident modeling and analysis.

In January of 2016, the Zone One Operations Chiefs were given a demonstration of the product. Most were impressed, but one of the downsides of the product was that when purchased, the license only allowed the department to look at and analyze the incidents in their jurisdiction.

Because of how Zone One operates with its robust automatic aid, it was identified that only by having all of the zones jurisdiction's data to utilize, could any single jurisdiction truly analyze its responses. Also being able to look at the Zone as a whole provided much better comprehensive planning and analysis.

It was also identified that NORCOM had the most consistent and reliable zone-wide data and best technical expertise and capacity to host the product. It was then proposed that if NORCOM was to become the primary customer, utilizing all of the Zone data, then jurisdictions could opt in and pay for their share if they wanted access to the product.

With a lot of work by the NORCOM staff and faith from the agencies, in 2016 a contract was signed with NORCOM and the following agencies:

- Bellevue Fire Department
- Eastside Fire and Rescue
- Shoreline Fire Department
- Redmond Fire Department
- Woodinville Fire and Rescue
- Mercer Island Fire Department

In late 2016, a Code 3 Simulator User Group was created between participating agencies for the purpose of sharing information, expertise and joint strategic analysis. Other agencies have, or will be signing on during 2017.

Code 3 Simulator product is an example of the predictive simulation category of modern software systems. It has a suite of incident distribution analysis tools, as well as predictive simulation.

Within a matter of seconds, it enables an agency to move resources around among stations, or move stations around within the jurisdiction.

An agency can make apparatus or people available at selected times, test reassigning busy sectors of your jurisdiction from one station to another, and pre-qualify changes in SOPs almost as quickly.

Then, almost equally quickly, you can “replay” the agency’s actual incident history against the new strategic model, and see results within a few seconds.

Case Study #1:

As an experiment, more so than any actual pursuit of a plan, Eastside Fire & Rescue chose to tackle this hypothetical scenario:

1) Assume Stations 78 (May Valley), 85 (Carnation), and 87 (North Bend) were “fixed” since they serve specific areas without any nearby EF&R backup.
2) Assume that Station 72, in Issaquah, is a “must have” station, due to its recent construction and cost.
3) Assume the remaining five career stations; 2 in Issaquah (71 and 73) and 3 in Sammamish (81, 82, and 83) were all “up for grabs”. They could be closed or moved in whatever way provided the best coverage for the Issaquah-Sammamish area.

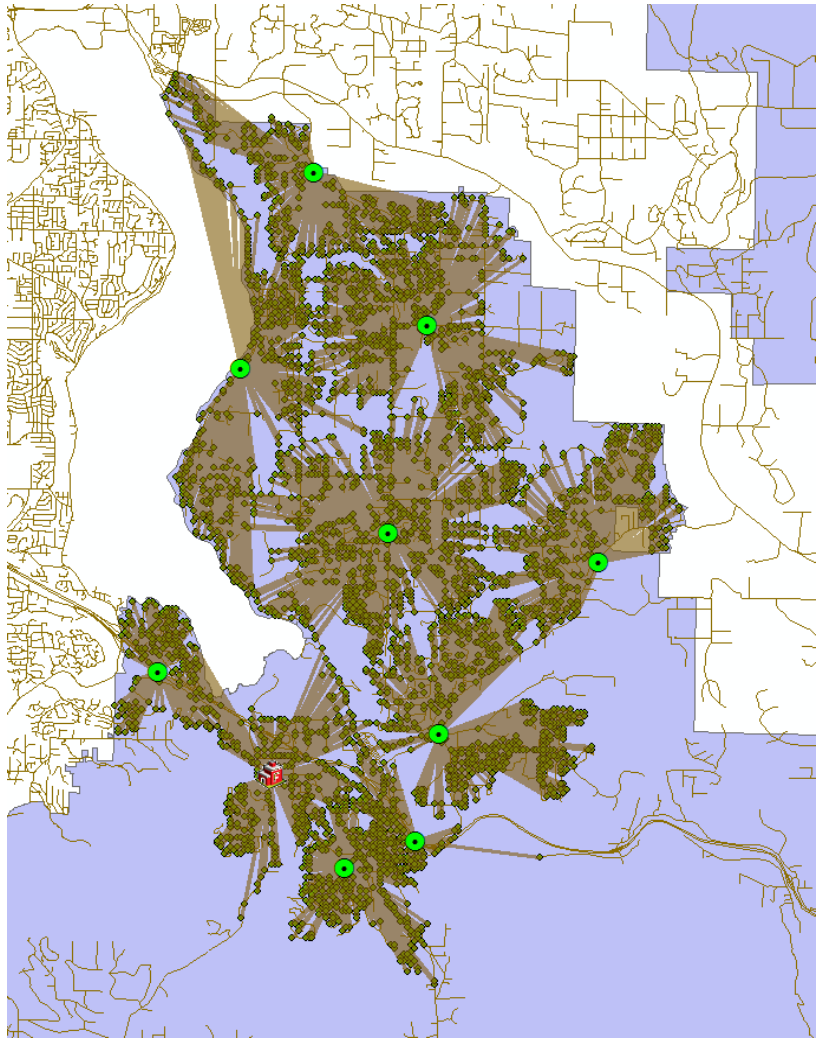
With that in mind, the first step was to use GIS software (Network Analyst). Two pieces of data were loaded into GIS:

1) All incidents in the Issaquah-Sammamish area from 2012 through 2015.
2) All vertices in the street network. i.e. everywhere two street segments touched.

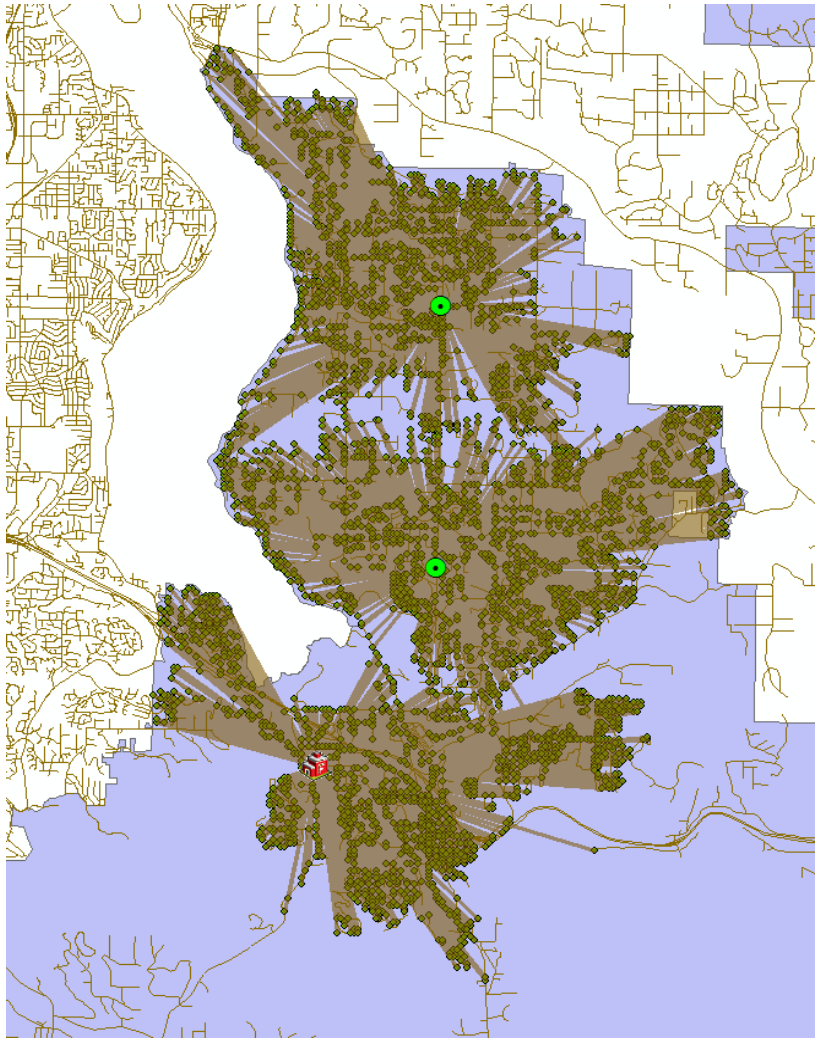
The software was then given this problem to solve: Where are the optimal locations to place the fewest number of stations (using the vertices as options) in order to reach all of the incidents within X minutes?

Here are the results:

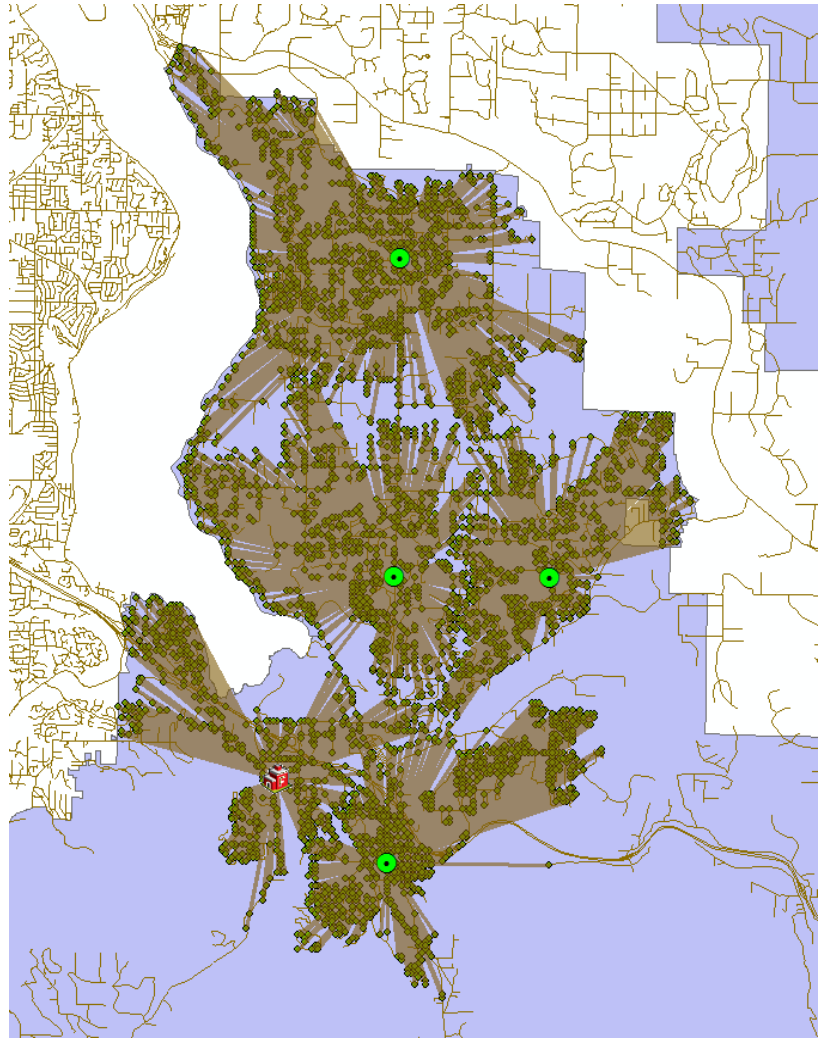
Within 5 minutes
Requires 9 Stations



Within 10 minutes
Only Requires 3 Stations



Within 7 minutes
Requires 5 Stations



The 7-minute, 5-station solution seemed to be the most reasonable of the three. It is important to keep in mind that this part of the process did not differentiate between the types of calls; treating a bark fire the same as a cardiac arrest. Further, it didn't consider the "reality" of being able to place a station anywhere (is there land available, etc.). It also did nothing to consider workload, timing of incidents, etc. It is purely "point A to point B in X minutes".

Using that solution, we then constructed a model with Code-3 to match.

1) As mentioned before, Station 72 remained where it is today
2) Station 82 remained in its current location
3) Station 81 moved to the area of Spiritwood at Pine Lake
4) Station 83 moved to the area of Beaver Lake Middle School
5) Station 71 moved to the intersection of Front & Sunset
6) Station 73 was closed

Closing a station provided three additional "bodies" that could be distributed among the other stations. For modeling purposes, those were distributed among three of the five stations, and then two additional bodies were "bought", creating 4-person staffing at the five Issaquah-Sammamish stations.

Additionally, required Engine staffing was increased from three to four persons, and a second Aid car was added to each of these stations. Response Plans in the Issaquah-Sammamish area were altered to require these 4-person Engines whenever available, but willing to accept 3-person.

The theory behind this staffing model is this:

Today, with 3-person staffing, any incident that pulls a response from any station places that station completely out of service. Roughly 60%-70% of our modern day responses are EMS incidents, the majority of which are BLS. Having 4-person staffing allows a station to respond 2 people on an Aid unit to a medical emergency, and to transport if necessary, without placing their station completely out of service for an extended period of time. 2 personnel would be left behind and able to respond to any subsequent EMS call.

The station would be unavailable for any fire response, but that is no different than it is today. However, if a station were pulled for an actual fire emergency, immediately upon arrival you would have your 2-in/2-out staffing. With today's 3-person engine staffing, it requires two units on scene before you can undertake an offensive attack.

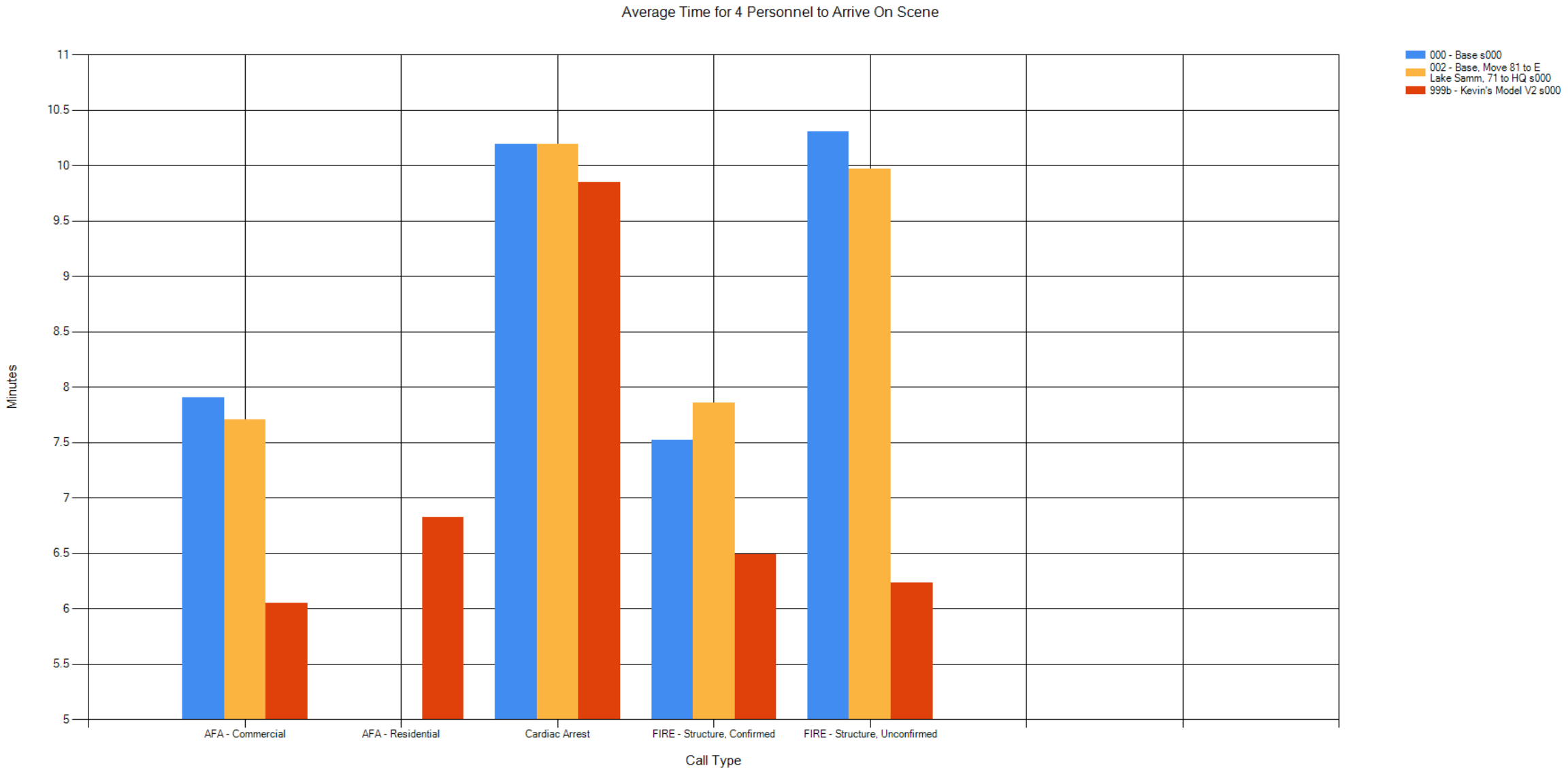
Because 3-person staffing on an engine is acceptable, if not ideal, then on those days where there was an unexpected absence, there would be no need to scramble to find (or mandate) overtime coverage. Dropping to 3-person staffing at a station on those days would be no different than it is today. Obviously, that would all be a matter of individual department policy.

Once that model was constructed in Code-3, it was compared along side today's current station location/staffing as well as another model that used today's staffing, but moved Station 71 to the current HQ location and moved Station 81 down onto property on E Lake Sammamish Pky. These three models were run against the same 4-year call load (2012-2015) that was used in the GIS modeling. However, in Code-3 the incidents from the whole of Zone 1 were modeled, not just Issaquah-Sammamish. That allows you to consider the effects of auto-aid, etc. BUT you can then filter those results down to see only the impact on your focus area.

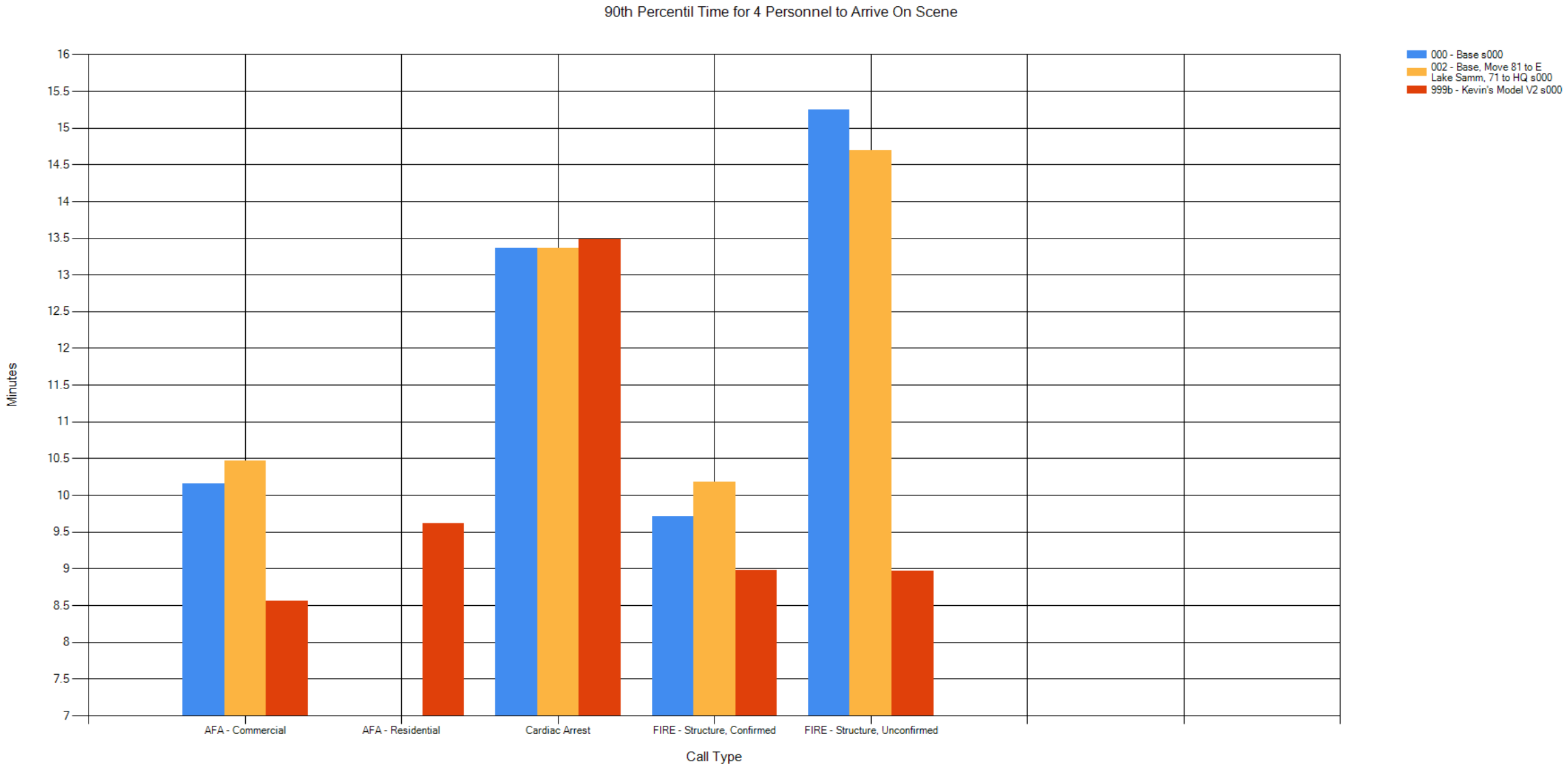
When running through the calls, Code-3 goes through each call chronologically, assigning appropriate units based on the response plans you have built in the model, and modeling their behavior (how long they stay on scene, do they return to quarters in or out of service, was there a transport, etc.). In this way, it allows you to effectively ask "what would things have looked like if we had THIS setup instead of THAT setup?" It allows you to focus in at a very granular level, not only telling you which model is better, but also by how much, in a variety of ways.

Here were the results (remember, these compare only the effect on Issaquah-Sammamish incidents) …

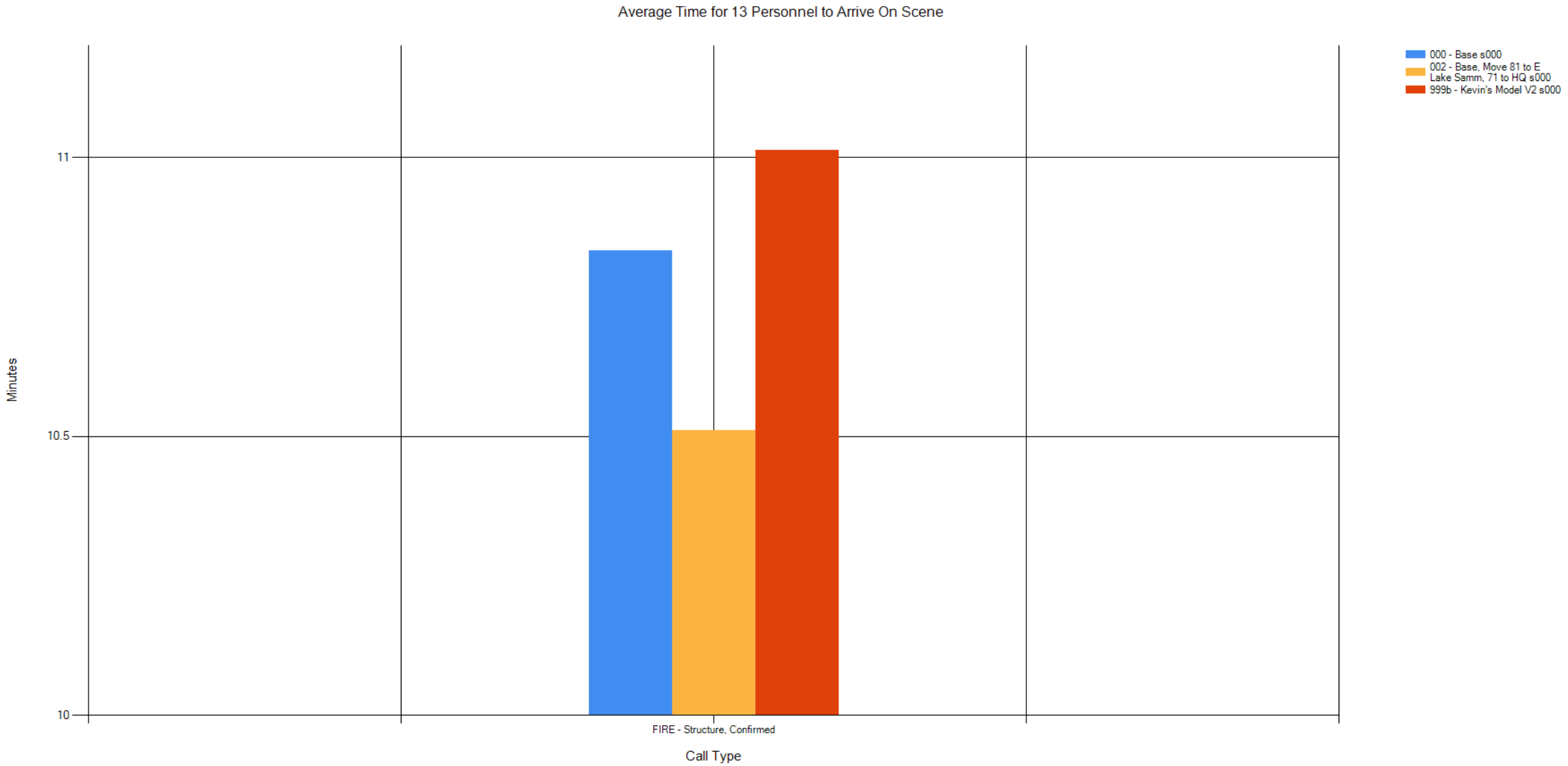
4-personnel average on scene time was significantly improved. Note that in “today’s” modeling, a single 3-person engine is all that is required on a residential AFA. That is why there are no results for the other two models in that category.



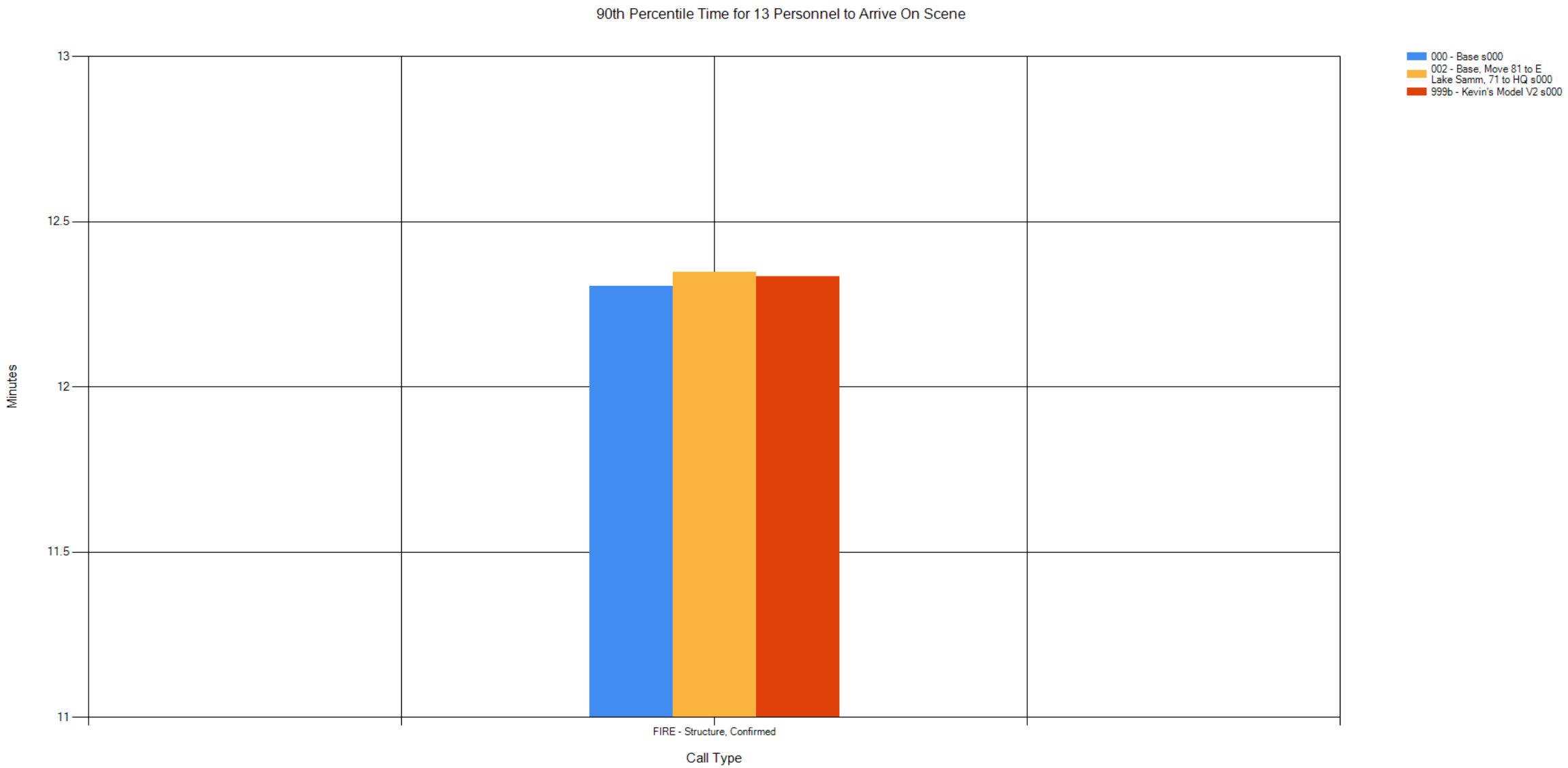
The 90th percentile time also shows significant improvement. On Cardiac Arrests, there is actually a slight increase in the time, which is understandable due to the elimination of a station, and spreading out the locations of the others.



The average time to get 13 personnel on scene of Confirmed Fires is longer, due to the same issue as Cardiac Arrests. However, with the significant improvement of on scene time for 2-in/2-out, perhaps fewer fires would grow to Confirmed.



At the 90th percentile, the times for 13 on scene of Confirmed Fires are all comparable.



A comparison map shows where each model performs better.