CABLELINK SOLUTIONS

CASE STUDY:

New Chapel Hill ISD D.A.S. (Distributed Antenna System) Install

12/8/2021

The East Texas terrain with its rolling hills and pine trees can make cellular service spotty at best. Unless you are close to the right provider's tower. The New Chapel Hill users happen to be far enough away from Tyler that those towers don't really help. Also, they are far enough away from Interstate 20 that those interstate highway towers don't factor in either. Being on Texas State Highway 64 the cell tower infrastructure is decent but not great in the area. So, they have to make due with a few scattered towers along the highway. Considering that most current 3G and 4G towers are designed to provide an acceptable signal to about 7 miles from the tower. Current coverage cells try to extend no more than that. Needless to say, there are plenty of dead spots for cellular coverage in the area.

The New Chapel Hill school district serving approximately 3500 students, is a small school district just east of Tyler, Texas. The District needed to find a way to have a stronger and more reliable cell signal inside the different buildings in the schools if for nothing else for a safety issue. The school district uses a popular educational emergency app on cell phones called Raptor by Raptor Technologies. The Raptor app has the ability to send out emergency alerts, in cases of natural disasters or school lock downs. As well as logging volunteers or screening visitors that are on campus. The problem is that the cell phone using it needs at least a fair quality signal to be able to communicate with the app and information coming from it from the main office of the school. In many cases the teaches had little or no cell signal depending on what part of the school they were in.

So, with money from an E-Rate request and using some local funds, New Chapel Hill ISD wanted to install at least the backbone of a passive D.A.S. system on all of their main educational buildings. Keep in mind that the placement of these initial indoor antennas is only focusing on the coverage for the administrative sections of each campus. Later installs will look to boost service in the other parts of the school where service is lacking over successive upgrade projects. This project was just covering the initial systems.

Below is a brief description of the work that Cablelink Solutions-Texas provided for the District and what products where used in creating their D.A.S. Cellular Boosters for the separate locations.

List of Passive D.A.S. Components we used to create each location's system.

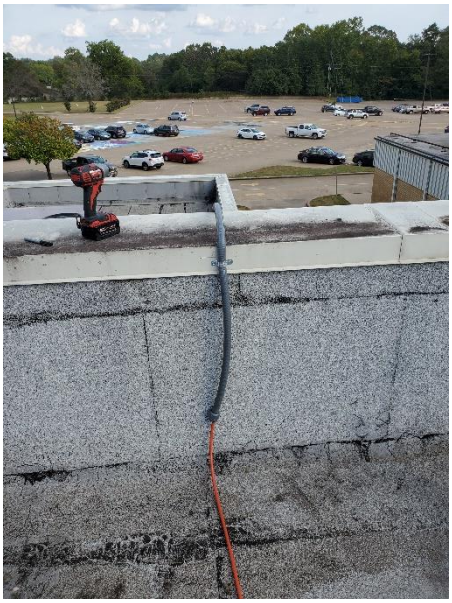
All the components listed except for the Roof sled antenna are Wilson Pro products unless otherwise noted.

WILSON PRO 1300 ENTERPRISE D.A.S. Bi-Amp. It's a Bi-Amp because it can amplify the cellular signal in both directions. At each location we used the Wilson Pro 1300 Enterprise series Bi-Amp. This unit allows for 3 separate antenna feeds and 1 output to the interior Server antennas. The Interactive touch screen on the front of the unit makes any setup easy. It also has a cell card installed so it can be monitored remotely and a UTP ethernet port also allows it to be locally configured via a laptop. One thing to note about this model is that you either have to have one or three antennas connected. It is not designed to work with only two antennas. This unit handles the current 3G, 4G LTE and 5G established frequency bands. The 1300 Enterprise handles Band 5 Cell, Band 4 AWS, Band 25 Extended PCS, Band 12 LTE Lower and Band 13 LTE Upper Cellular Bands. These are displayed on the touch screen and if needed Bands can be blocked via the front touch screen. Using one antenna it works in common mode, all the bands are combined from the single antenna. Using 3 antennas you can put it into split mode and that will allow you to divide up the bands according to which antenna is getting the best signal.

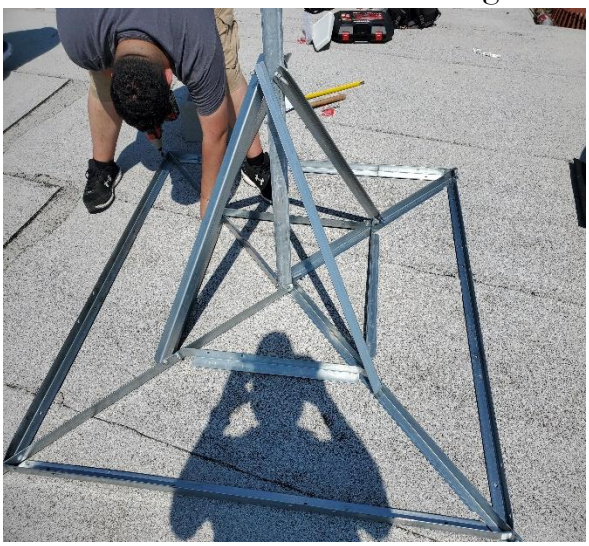
GROUNDING FOR OUTDOOR ANTENNA FEED: Having an antenna mast on top on a roof in a part of Texas that can have intense electrical thunderstorms meant we also needed a reliable way to ground the system. Primarily so that if lightening struck the roof antenna sled that any internal building and equipment damage would be minimized. We used an in-line grounding device that connected to incoming outdoor cable coming from the Outdoor Antenna. Then added a short section out the other end to the Enterprise 1300 unit. We grounded the grounding device to a proper ground point with #6 Awg stranded wire.

LMR 400 COAXIAL CABLE.: The LMR 400 cable using N-Type compression crimp connectors gives a good cable distance with acceptable signal loss. We tried to keep our runs within the 150 ft range to minimize signal lost due to the cable. Luckily with the design help from Wilson Pro the different runs fell within acceptable loss levels to still achieve the signal boost needed. The cable was plenum rated to comply with the local fire codes.

OUTSIDE PENETRATIONS: All the penetrations we did to take the cable to the roof were performed on the side of the building. We didn't want to have the possible liability of a roof leak due to a badly sealed roof penetration. Going into a weatherproof Cantex plastic style Nema rated box. This also helped with the cable transition. To make sure that the rather stiff LMR 400 cable kept a proper bend radius. We also mounted a length of seal tight flexible conduit to the Cantex box to get it up and over the roof edge so that the actual Indoor/outdoor LMR 400 cable is not subject to any extra abrasion or wind damage from roof walls or flashing. Dressing the seal tight with a drip loop out of the box also helps prevent water from flowing back into the box down the cable.



ANTENNA MASTS: Following the same theme as with non-roof penetrations we used free standing antenna sleds placed on top of protective rubber mats and weighted down with cinder blocks. Once again, we didn't make any sort of roof penetration on any of the locations, that we installed our systems. As an added benefit if we need to move an antenna sled in the future, we simply remove the blocks, move it to its new location and replace the blocks to weigh it down.



YAGI OUTDOOR DONOR ANTENNAS: In all the antenna locations we used semi directional Yagi antennas. Due to the weaker signal strength an Omni directional type antenna really wasn't an option. The Yagi allowed us to aim it at the direction of one or two different cell towers off in the distance. Being a rural area with rolling hills the Cell towers are spread out and the Yagi's flexibility made it work great for this application. We also used heat shrink tubing to cover the connection from the LMR 400 cable to the antennas twist on connector to prevent weather issues.

INDOOR LOW-PROFILE DOME WITH REFLECTOR SERVER ANTENNAS:

We used this model of indoor antenna because of its low profile and its great coverage radius. Mounted in drop ceilings all you really see if you look up is a white flat 8" circle on the bottom side of the ceiling tile. In some cases, we had to point them out to the customer because they blended in so well.

Demographics of Chapel Hill ISD

The schools

The district serves 3,534 students combined at the 5 schools.

Each location had its own unique challenges to overcome. Mostly relating to where the site was located in relation to terrain and also cell towers. In many cases these buildings are located right next to each other.

The main district educational complex has the Highschool, the Junior High, Career Technology Education (C.T.E.) building separated by a circular bus stop drive. South and down the hill of the Junior High and C.T.E. building is where the AG Barn was recently built. Just a little perspective, the C.T.E. building is higher in elevation that the High School and Junior High. Built at the top of the hill on the west side. Below the C.T.E building is the High School and lower and to the South of the high School is the Junior High

- **High School** (9-12) - 1026 students

The high school was of course the largest location. We needed two separate systems to handle the unique issues for each of these areas. The High School is primarily a single-story building. That being said it still has a large footprint. The additions over the years also seem to show up by the different roof levels.

We installed one in the MDF closet in the Main office area. This is the center of the entire high school. Being a single-story High school, it has a large sprawling footprint. We ran a cable to the exterior Yagi antenna to mount on the roof. Because there were different height roofs right on the edge of the administration office, we were able to do an outside wall penetration and then mount out an Antenna and sled on the higher roof. We installed 3 Low profile server antennas in the General admin. area. This greatly improved the cell signal in and around the main office area.

The second location was the principal's office. The school Principal has an office on the far east side of the High School. Once again, this area had almost no reliable cell signal. Separated from the main office area by two large gyms, a dance studio and two hallways. The distance was completely outside of the acceptable signal loss parameters. So, we needed a completely separate system for this area. We ran a line for the antenna that basically had it on the roof above the office. Then we installed a dome antenna in the center of the office. Since the suite was so open one server antenna worked well for the area.

- **Middle School** (6-8) - 777 students

The Junior High(Middle School) Had a single Enterprise 1300 installed. From it were able to serve four low profile dome antennas. This is the recommended maximum number of Server antennas to be attached to the 1300 series to still maintain an adequate signal boost level since it only has a single server antenna connection. All antennas attached need to be combined together via a splitter before the single cable goes to the Bi-Amp unit

- **Career and Technology Education Building:**

We Installed a Single Enterprise 1300 unit in the buildings MDF room. We put one server low profile antenna in the Main office and one in the hallway. This gave us good coverage of the administrative area.

- **Kissam Intermediate** (PreK-5) - 776 students

In Kissam we departed a little from how we installed the Bi-Amp in the other locations. Instead of putting the Bi-Amp unit in one of the Telecommunications closets we put it in the front receptionist office. This was the best location to reduce the length of the Indoor server antenna runs as well as keeping the length of the Outdoor Donor antenna cable down. The low profile of the wall mount version of the Enterprise 1300 allows it to be mounted almost anywhere.

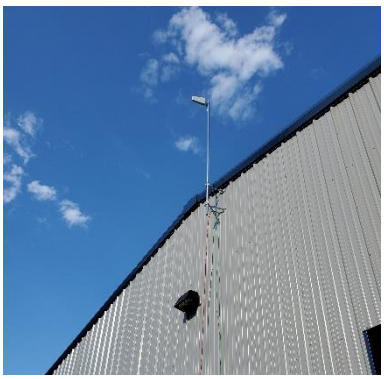
- **Jackson Elementary** (PreK-5) - 419 students

All the other New Chapel Hill ISD schools are placed along Texas State Highway 64 except Jackson Elementary. Jackson is on the far Northeastern corner of the district. Between State Highway 64 and Interstate 20. Its on the northeast side of the towers on State Hwy 64 and on the fringe of their coverage area. Rolling Pine tree stands also add to the weak signal. The I-20 towers are just out of range. So, this was probably the most challenging of the main schools to get a focused signal. The three indoor server antennas helped to improve each areas overall cell signal.

- **Wise Elementary** Fine Arts Magnet (PreK-5) - 539 students

This location needed the least amount of help of all the other sites since it was the closest to Tyler and some of the Cell towers associated with the larger town. We installed 2 Inside server antennas and it help even out and get good cell signal for all of the prominent area cell carriers. Before the only decent single was from the Carrier who had the close tower. All others were weak in comparison.

- **<u>The New AG-Barn</u>**: Built for the FFA students to have a place to care for their animals, a classroom, and a small arena to have FFA Events. Built down in a depression, south of the High School, Junior High and C.T.E. They were getting absolutely no signal from any of the 5 Bands inside the facility. This was also a safety issue because a few months earlier a student was injured while tending to some of the livestock after normal classroom hours. So, to get a cell signal to call for help, another student had to walk up hill several hundred feet towards the main school complex until they were able to get a cell signal.



Built on the lowest part of the Main school complex, it took an antenna mast mounted on top of the peak of the AG building to get it to about the same level as the top of the scoreboard on the adjacent baseball field that is up on a hill to the west. The peak is approximately 30ft high, with about 8ft more of the antenna mast above the roof line. We installed an Enterprise 1300 unit and 2 low profile dome antennas. One in the AG classroom and one in the girl's bathroom near the east wall. That allows signal for some of the open areas under the roof canopy and in the storage area next door. The district has already decided to have us add an additional Antenna in the arena part under the Canopy since the other two were working so well. They have District events there and although the signal has improved by installing the indoor antennas. A dedicated antenna in the arena area would greatly improve the reception available.

<u>IN CONCLUSION:</u>

Cablelink Solutions-Texas was able to deliver the required systems to each location on time and in budget. It worked out so well that the District has already identified a couple more locations that they want the Wilson Pro DAS Cell booster systems added to. So, we are scheduled to add a system to the Athletic Center and the District Network Operations Center (N.O.C.). Later on, other parts of the schools that had the base systems installed with remaining dead spots will be taken care of. Mainly these dead spots are in the classroom wings.

Cablelink Solutions-Texas is the company you can call on to help design and install your Passive D.A.S. Cellular systems. Especially for the Wilson Pro line of products since we are a factory trained installer for Wilson Pro's line of products.