

**Purpose:** The purpose of this document is to address questions raised about the potential use of the tower at John Ball Zoo and the potential for a new tower.

**Background:** The existing John Ball Zoo site is a 165' monopole tower located on the Zoo property. A picture of the tower is shown below:



The tower currently supports several City of Grand Rapids uses including the police department, as well as the water and traffic departments.

The tower also supports installations by commercial service providers T-Mobile and Verizon. According to the leases with Kent County, each of these service providers is permitted to mount up to 12 antennas at a single mounting height.

**Issue:** An issue arose when the first structural analysis performed with the intent of adding the equipment proposed for the Kent County Dispatch Authority's new system did not include all "permitted" equipment per the T-Mobile and Verizon leases. As a result, the project team was required to perform additional analysis.

The project team has now performed additional analysis which includes the additional equipment anticipated for T-Mobile and Verizon, in addition to evaluating the possibility of building a new tower.

It should be noted that the structural analyses performed are done based on an existing tower in good condition and installed properly and as designed. This is common in the industry as the firm performing the structural analysis may not have personally inspected the tower and is relying on the data provided and inspection by others. Tower owners are responsible for performing periodic inspections according to industry standard (TIA) guidelines. In the case of JBZ, a tower mapping was also performed to map the existing equipment on the tower, and no maintenance or damage issues were found at that time.

## Questions:

- 1. For the JBZ analysis, what is the structural loading at? How does this compare with our other towers/water tanks?*

The latest analysis shows the tower loaded to approximately 85% of capacity, which is at or below most towers that have been analyzed. This analysis included all equipment currently on the tower, as well as planned enhancements by T-Mobile and Verizon, as well as the new KCDA equipment. Some equipment will eventually be removed from the tower once users are transitioned to the new system, which will reduce the loading on the tower.

Structural loading of a variety of towers on similar projects, including those in Michigan generally show loading values between 70 and 105% (105% is considered the maximum acceptable). Some towers on another project have been remediated in order to be used and are still loaded at approximately 100%.

The predicted “twist and sway” of the tower is near or in some cases above the generally recommended level for microwave links. This has not been an issue identified with other towers in use for the project and does present an issue to be investigated and addressed.

This issue can be resolved by reducing the loading on the tower and/or installing the microwave dishes at a lower height. Both of these options are being pursued.

- 2. What would be the capacity available at JBZ after all equipment is on. Is it maxed out? Can we add pieces? How does this compare with our other sites.*

The 85% capacity identified above is with all planned equipment on the tower, even before some equipment planned for removal is taken down. There would be capacity for additional equipment if needed, although no additional equipment for the KCDA system is anticipated. In addition to the loading capacity, the twist and sway of the tower would also need to be evaluated if additional equipment were planned for the tower.

Other sites in the system are at similar capacity levels and all would need to be evaluated if additional equipment were planned. However, no additional equipment is anticipated for the KCDA system.

*2a. What is the cost to remediate the JBZ tower? Or does it need zero remediation? Could it be remediated in the future if there was a need to strengthen it for additional equipment?*

No remediation is necessary or planned for the JBZ tower. Some costs will be associated with the removal of antennas that would no longer be needed or moving antennas to another location if determined to be advantageous (see question 7).

*2b. Is there foreseeable equipment that is necessary for the 800mhz system in the planned future? Are there discussions about this by MPSCS.*

No additional equipment is planned. The current configuration with three transmit antennas and two receive antennas provides the capability to add additional channels if necessary, which would be the most likely “upgrade”. Also, the two microwave dishes in the current configuration provide the necessary connectivity for the site and the design includes spare capacity.

There have not been any discussions with MPSCS regarding additional equipment, since none is anticipated.

*3. Can we put up another monopole and leave the existing pole? What would be the cost to do so?*

Yes, a new monopole could be erected at the site. The cost for a new monopole is estimated to be \$250 - \$300 thousand.

*4. Can we put up a self-support tower and leave up the existing pole? What would be the cost to do this?*

Yes. The cost is estimated to be \$300 - \$350 thousand.

*5. What is the cost to move the commercial equipment if we use the existing pole?*

There are no plans to move any of the commercial equipment currently in use or planned for T-Mobile and Verizon. The recent structural analyses indicate this equipment can be accommodated with the existing tower.

*6. What would be the cost if we, a) built a new tower, b) moved all of the equipment from the old tower to the new tower, and c) demolished the old tower.*

The estimated cost of building a new self-supporting tower and performing these additional activities is \$400 - \$500 thousand.

7. *If we can get the 800mhz antenna above 110' to as high as 165' what is the coverage difference between these heights and between the 165' and the 230'?*

We have developed a plan that would accomplish this. It would require either eliminating some City non public safety (water and traffic) antennas or moving them to a nearby tower such as the Covell Ave. tower. Discussions with these agencies has just been initiated.

Coverage predictions have been developed by Motorola and are shown below. In each of these images, the predicted coverage from the system as currently planned is shown, in addition to additional coverage if the antennas were moved to the top of the existing JBZ tower and also if the antennas were at the top of a new 230' self-supporting tower at the JBZ location. It can be seen that an increase in in-building coverage is achieved when the antennas are moved higher at JBZ. Further in-building coverage gains can be achieved by elevating the antennas to 230', although these incremental improvements are not as significant.

8. *Why would we not install the equipment on the existing JBZ tower if it meets the structural requirements?*

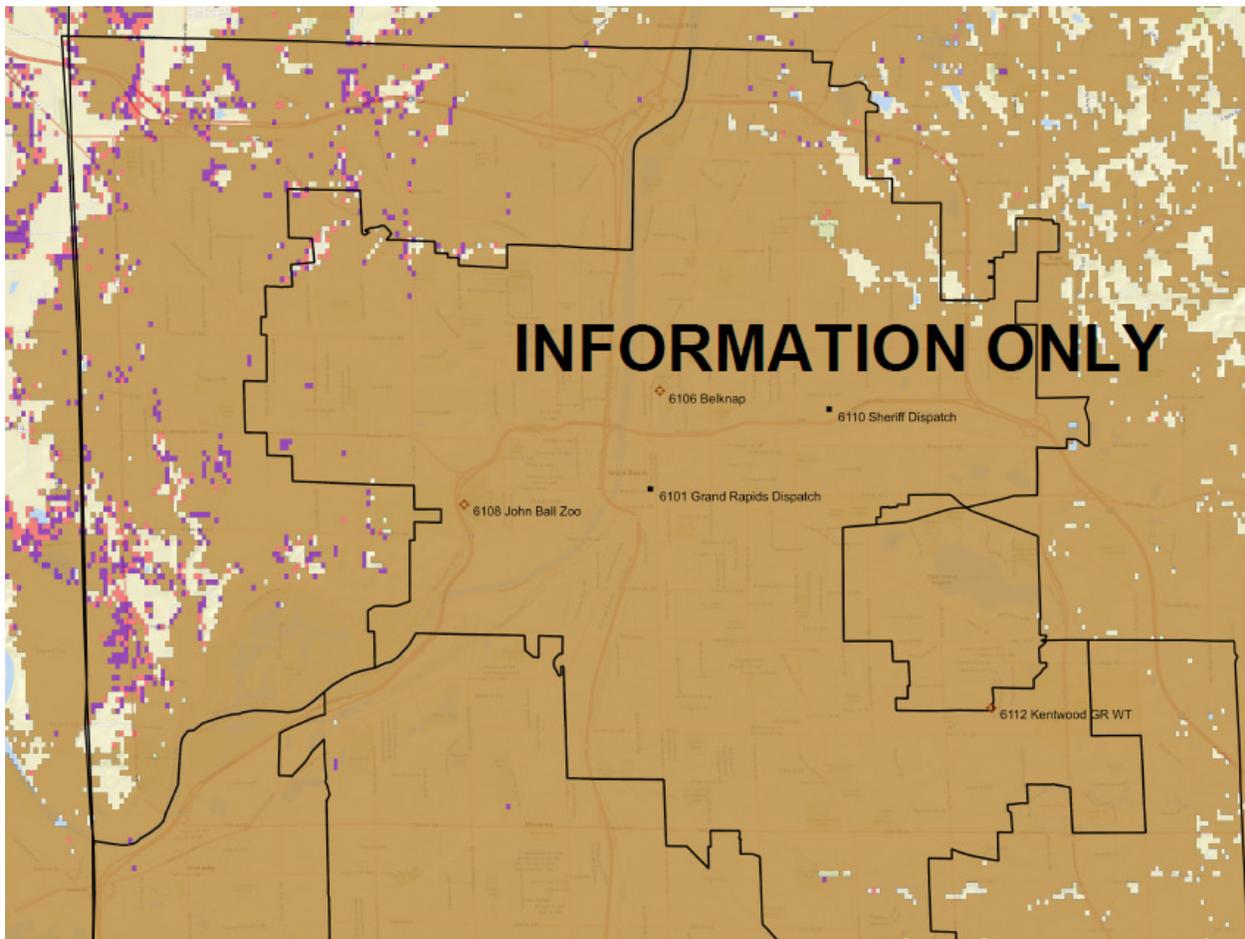
Given that the tower passes the structural analysis and that Nokia has confirmed the twist and sway requirements, which our analysis indicates can be achieved, the tower will be perfectly acceptable to use.

From an RF perspective, more height is almost always preferred and will generally provide better in-building coverage in the surrounding areas. However, a cost-benefit analysis should be performed to determine if the cost to achieve the additional coverage is justified. Factors to be considered include:

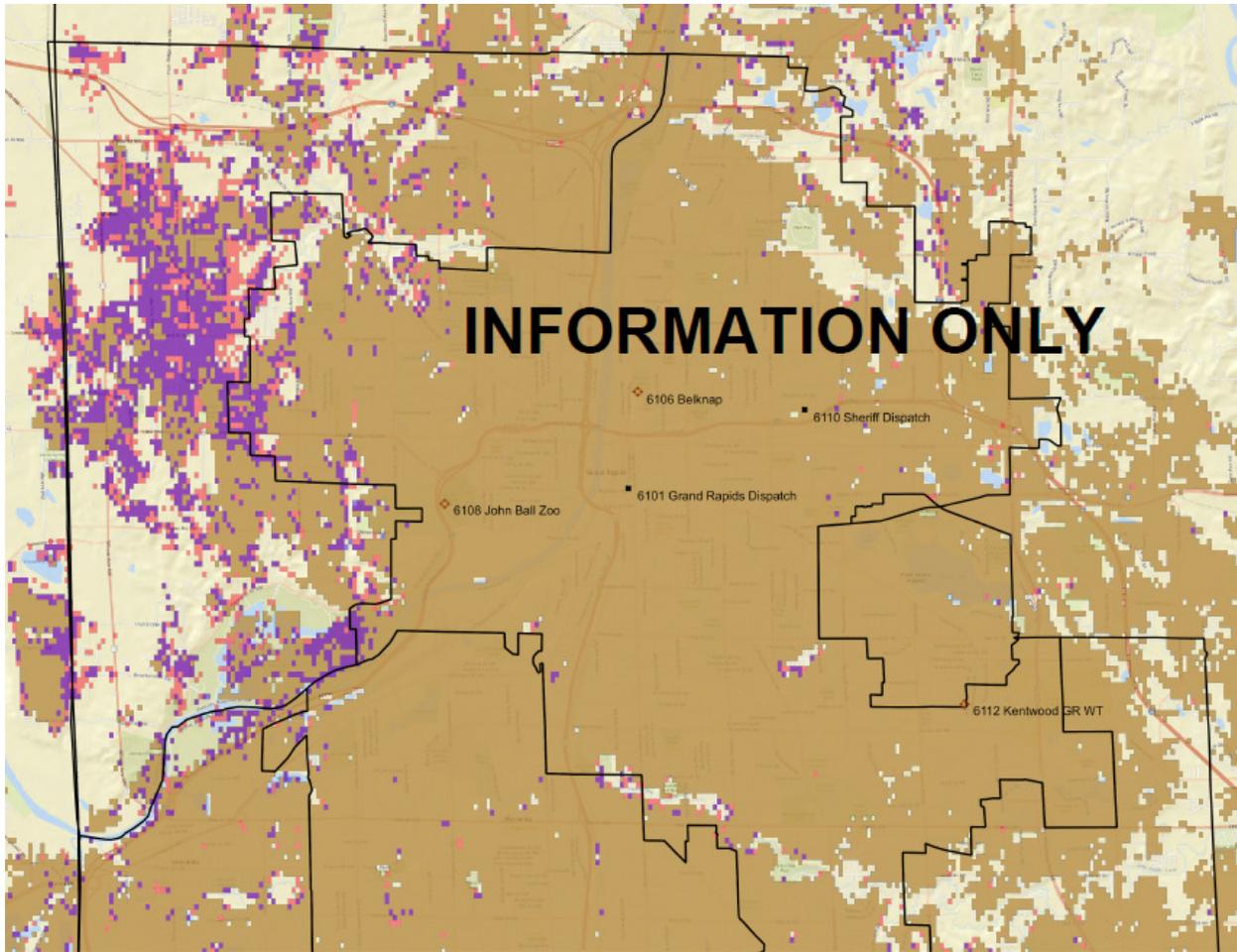
- The level of additional building coverage provided
- The need for additional building coverage in the area provided
- The cost of the upgrade.

Televate recommends utilizing the existing JBZ tower, given the following:

- The tower currently meets the structural loading requirements
- Equipment adjustments can be made such that the microwave dishes will be within the specified limit for twist and sway
- The system is expected to meet the contractually-committed coverage requirements at the baseline antenna height on the current tower
- All previously identified critical buildings in the surrounding areas are predicted to receive at least the level of in-building coverage planned for those areas using the current tower
- An option does exist at a relatively low cost to move the system antennas higher to provide improved coverage if deemed beneficial, and
- Any incremental further coverage improvement anticipated from a new tower does not appear to justify the cost and potential schedule impacts.



Predicted 15 dB In-Building Coverage (  Current predicted coverage,  Additional predicted coverage from antennas at the top of John Ball Zoo tower,  Further additional predicted coverage from antennas at the top of a new 230' self-supporting tower at John Ball Zoo)



Predicted 23 dB In-Building Coverage (  Current predicted coverage,  Additional predicted coverage from antennas at the top of John Ball Zoo tower,  Further additional predicted coverage from antennas at the top of a new 230' self-supporting tower at John Ball Zoo)