

Agenda
Joint City/County Commission Meeting
Monday, February 8, 2016
Rose Room
Ford County Government Center
6:00 PM
Meeting

CALL TO ORDER

COUNTY COMMISSION ROLL CALL: Chairman Tasset

CITY COMMISSION ROLL CALL: Mayor Warshaw

REPORTS:

1. **Field Sports Update**-Report by Director of Parks and Recreation Paul Lewis
2. **Long Branch Lagoon Aquatics Park Update**-Report by Director of Parks and Recreation Paul Lewis
3. **VenuWorks Update**-Report by VenuWorks United Wireless Arena and Conference Center Executive Director Chris Ragland
 - a). **VenuWorks and Lacuna Marketing Partnership Update**
 - b). **Conference Center Naming Rights Update**
 - c). **Potential Hockey Team Discussions Update**

UNFINISHED BUSINESS:

- 1.

NEW BUSINESS:

1. **CFAB Appointment**-Report by Project Development Coordinator Melissa McCoy
2. **Communications Report**-Report by Jack Hart, Tusa Consulting Services

UPCOMING MEETINGS:

1. Monday, May 9, 2016-6:00 pm-Joint Commission Meeting- City Commissioners
Chambers City Hall
2. Monday, August 8, 2016 6:00 pm -Joint Commission Meeting-Rose Room, Ford County
Government Center
3. Monday, November 14, 2016 6:00 pm -Joint Commission Meeting- City Commissioners
Chambers City Hall

1. ADJOURNMENT:

FORD COUNTY, KANSAS

VHF RADIO SYSTEM ASSESSMENT & RECOMMENDATIONS REPORT



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INTRODUCTION

Ford County (County) is located in southwestern Kansas. The County has a population of 33,848 and covers an area of 1,099 square miles. The County seat is Dodge City; Spearville and Bucklin are other population centers in the County. The County is served by a consolidated Public Safety Answering Point (PSAP) which handles all wireline and wireless 911 calls for law, fire and EMS services.

The County utilizes conventional VHF radio systems for its public safety and public service agencies. The Ford County Sheriff's Office, Dodge City Police, Dodge City Fire, and Ford County Fire are the primary public safety agencies. Dodge City Public Works and Ford County Road & Bridge are the primary public service agencies. Some agencies have radio equipment that can operate on the Kansas Statewide Interoperability Communications System (KSICS) 800 MHz P25 network. A State site is located in the east/central part of the County. The agencies report that they use the 800 MHz KSICS system only occasionally.

Ford County has retained Tusa Consulting Services (TCS) to conduct an assessment of the current VHF radio network and to provide recommendations for improvement.

TCS deliverables are:

Task 1 – System Assessment

- Inspect all Ford County/Dodge City radio sites and the 9-1-1 Dispatch Center.
- Meet with representatives of user agencies.
- Inspect current subscriber radio inventory (mobiles, portables, control stations).
- Develop computer-generated coverage maps showing current coverage of VHF system, and coverage from KSICS (Kansas Statewide Interoperable Communications System) 800 MHz site in and around the County
- Conduct a County-wide drive test of the State's 800 MHz system

Task 2 – Develop Recommendations

- Develop system improvement recommendations: upgrade of VHF system, transition to digital technology, etc.
- Provide coverage maps based upon conceptual designs.
- Submit a final report to the County including the recommendations and estimated costs of each design.
- Present findings and recommendations to the County

➤ *The following report addresses Tasks 1 & 2.*

TASK 1 – SYSTEM ASSESSMENT

1.1 Questionnaires

Prior to inspecting the radio system and interviewing users, a TCS Radio System Questionnaire was distributed to the user community. The Questionnaire is used to solicit system use and performance information from the user community; it asks for details about the user's equipment and perception of system operation. The Questionnaire specifically requests that the users identify any areas that might not be providing satisfactory service.

Questionnaires were received from Dodge City Fire, Dodge Police, Ford County Fire, Ford County Road & Bridge, the Ford County Sheriff's Office, and Ford County 9-1-1. The following is a summary of reported system performance problems identified by each agency:

Ford County 9-1-1 –

- Western Plains Hospital
- Bucklin
- Spearville
- Mall basement

Dodge City Fire –

- City boundaries
- Packing plants
- All large buildings

Dodge City Police –

- 2900 block of E. Trail – trailer park
- Hospital
- Basement of mall
- Comanche Middle School
- Cargill
- National Beef
- Walmart
- Dillons
- Courthouse
- City Hall
- Ford County Government Building

Ford County Fire/EMS –

- Casino
- Schools
- Large buildings

Ford County Road & Bridge –

- Bucklin
- Southwest

Ford County Sheriff –

- “Outlying communities” – east and southwest
- Jail, Courthouse
- Bucklin/Spearville, Dodge City
- Schools, DCCC, Hospital, Village Square Mall

Questionnaires results can be summarized as follows:

- County-wide coverage is unreliable.
Portable coverage is unsatisfactory across much of the County.
- In-building signal coverage within the boundaries of Dodge City is lacking.

These issues will be addressed in the Task 2 Recommendations section of this report.

1.2 County & Dodge City Sites

The County 9-1-1 Dispatch Center utilizes the following sites to support communications for County agencies and Dodge City agencies:

MRT tower: Hwy 283 South of Hwy 56 intersection – 1.3 mi. south of Dodge City

1. Sheriff’s Office – repeater
2. County Fire – repeater
3. County EMS – repeater
4. Mutual Aid – repeater
5. Road & Bridge – remote receiver

South 283 tower: Hwy 283 – 25.7 mi. south of Dodge City

1. Road & Bridge – repeater
2. S.O. 3 – repeater
3. Remote receivers for – S.O., County Fire, County EMS

Spearville:

1. Remote receivers for – S.O., County Fire, County EMS, R&B
2. Local S.O. repeater

Bucklin:

1. Remote receivers for – S.O., County Fire, County EMS, R&B
2. Local S.O. repeater

Dodge City PSAP: 100 Gunsmoke Street

1. Dodge City Police – repeaters for dispatch, tactical and talk-around
2. Dodge City Fire – repeaters for dispatch and tactical
3. Dodge City Public Works – repeater
4. Backup control stations

2022 Central Avenue: Water tower

1. UHF paging transmitter

“Local” VHF repeaters operating on dedicated channels for the Sheriff’s Office are located in Bucklin and Spearville. The Sheriff’s representatives report they rarely use those repeaters due to the need to switch the radio and because they cannot hear other units when switched to these repeaters.

County Jail – standalone internal VHF repeater – no connectivity to the “outside”

A “local” repeater is installed at Dodge City High School – USD#443

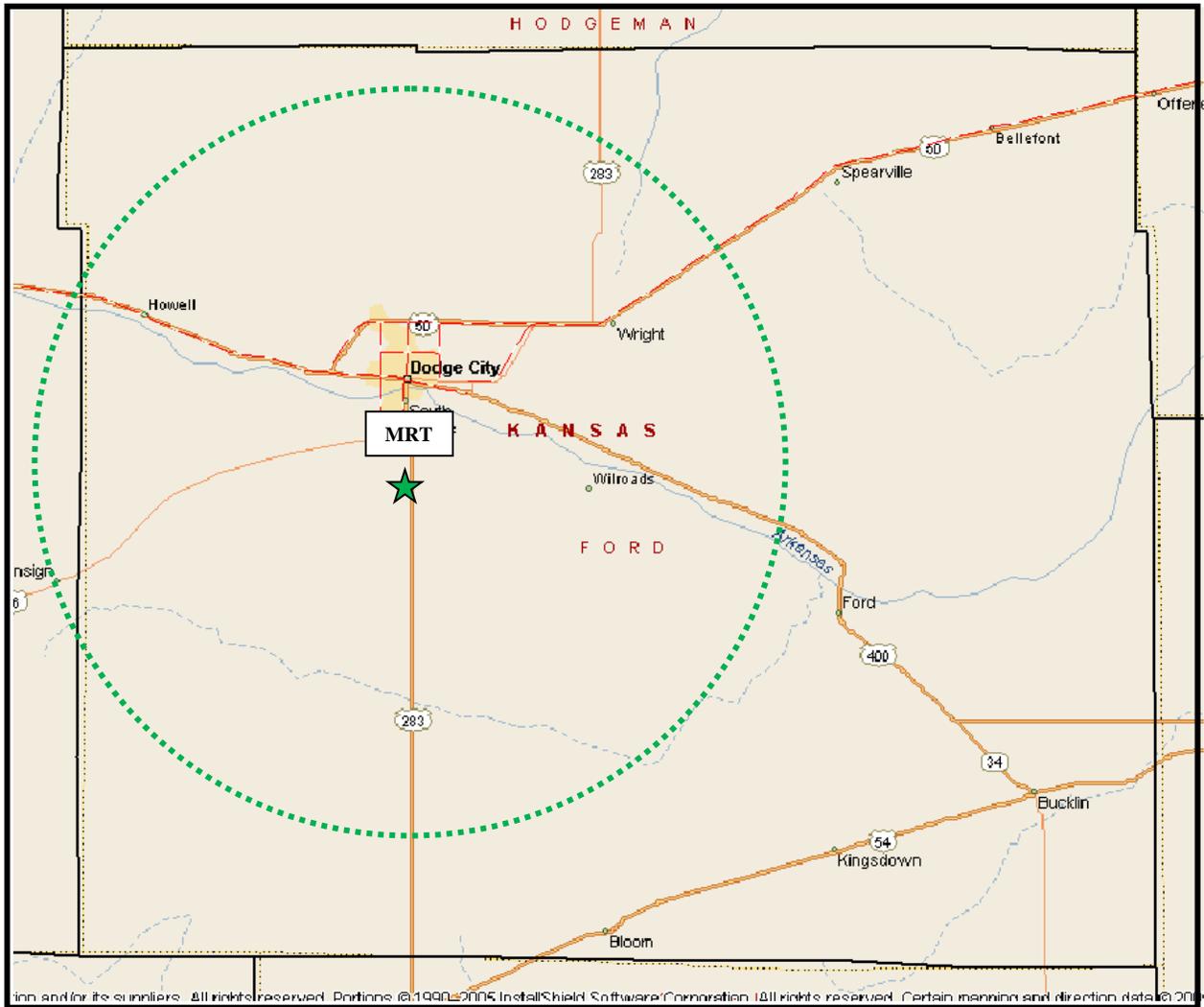
1.3 Coverage Analysis – County Agencies

Develop computer-generated coverage maps showing current coverage of VHF system, and coverage from KSICS (Kansas Statewide Interoperable Communications System) 800 MHz site in and around the County

Coverage maps have been developed using information obtained from the FCC licensing database. TCS uses the “portable-on-hip” as the standard for assessing radio systems. Our analysis does not consider “works sometimes”, “depends on the weather”, “works if the radio is held above my head” a good indicator of acceptable public-safety-grade radio system performance.

The following coverage model maps indicate coverage from a tower site to a portable radio worn on the hip, and coverage from a hip-worn portable radio back to a site. TCS uses “conservative” parameters in developing the maps. It is better to under-predict than over-predict.

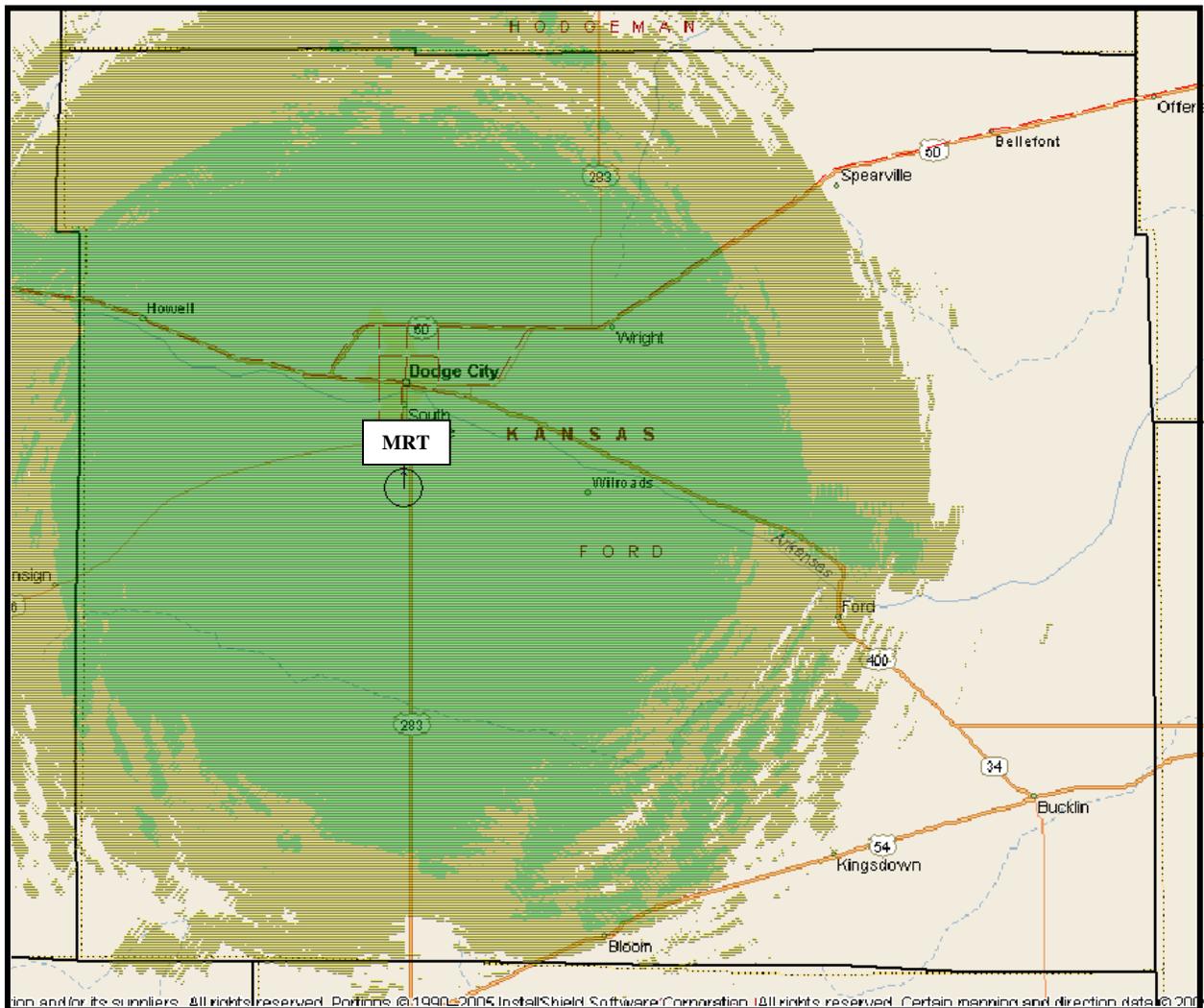
As is typical in VHF systems, the portable “talk-back” range is less than the tower site’s “talk-out” range. A repeater transmits at high power from an elevated antenna. The portable radio transmits at a much lower power from an inefficient antenna that is only 3 ft. off the ground.



Effective VHF portable radio talk-out coverage from the MRT tower for Sheriff, County Fire, County EMS, Mutual Aid

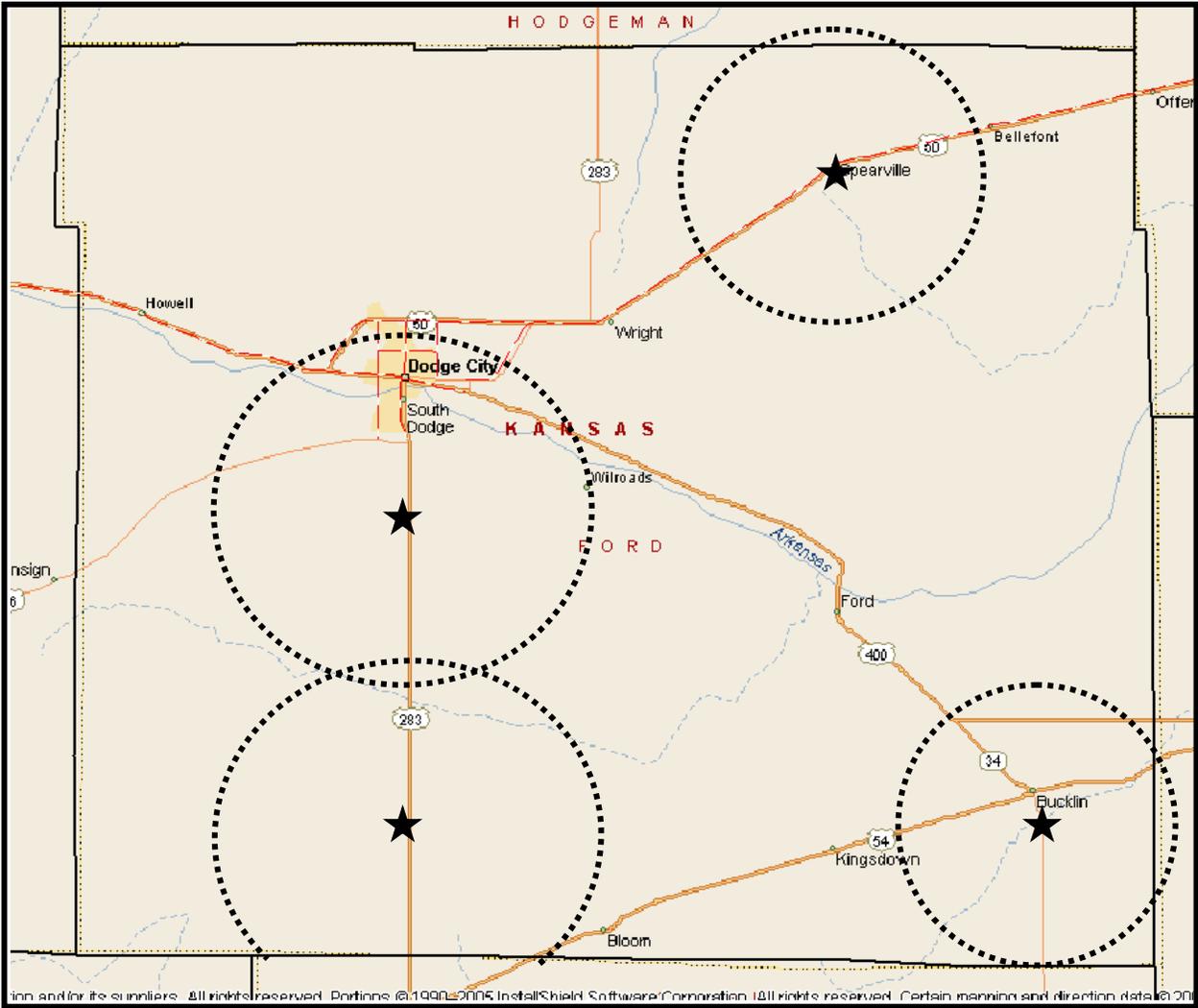
Analysis of coverage from the MRT site that serves the County’s public safety agencies indicates the transmitted signals from the site do not reliably cover the eastern area of the County. Both the Spearville and Bucklin receive sites are on the fringe of the transmitter’s signal (in regards to portable talk-out). As a result, an imbalance is created between what a portable can hear and what a dispatcher can hear. For example, while there is a good probability that Dispatch might hear a portable radio user in Spearville or Bucklin, the portable might not hear Dispatch.

The following is a computer analysis of VHF coverage from the MRT site.



VHF talk-out coverage from the MRT tower site

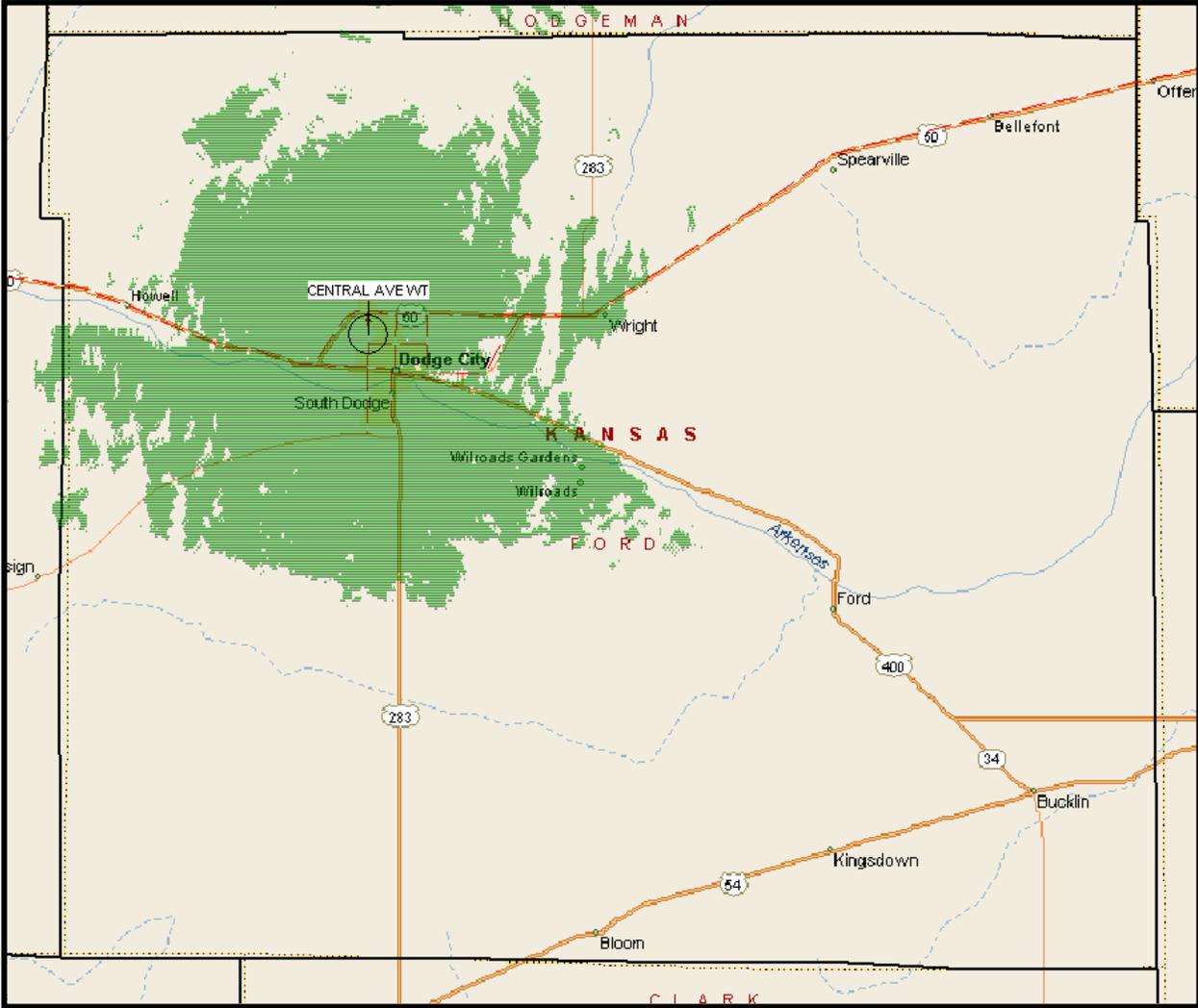
GREEN = portable-on-street coverage YELLOW = mobile coverage



Effective portable radio talk-in coverage from County sites

★ = remote receiver sites – MRT tower, S 283 tower, Spearville, Bucklin

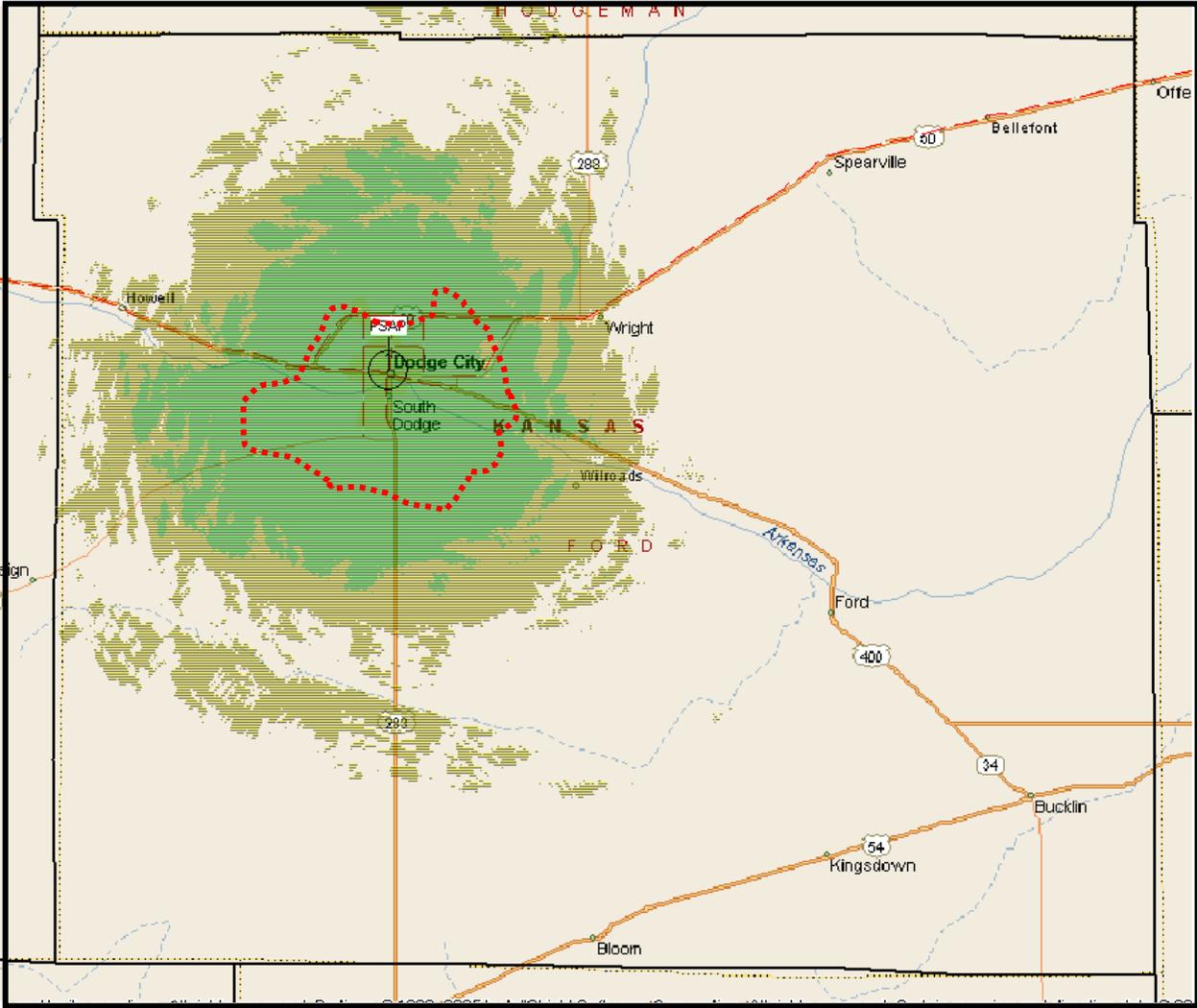
1.4 Coverage Analysis - UHF Paging



**Effective UHF Paging coverage from Central Avenue Water Tower
GREEN = -90 dBm**

This site is licensed for 548 Watts ERP. While this is a fairly high output power, the site's range is limited by the water tower's height.

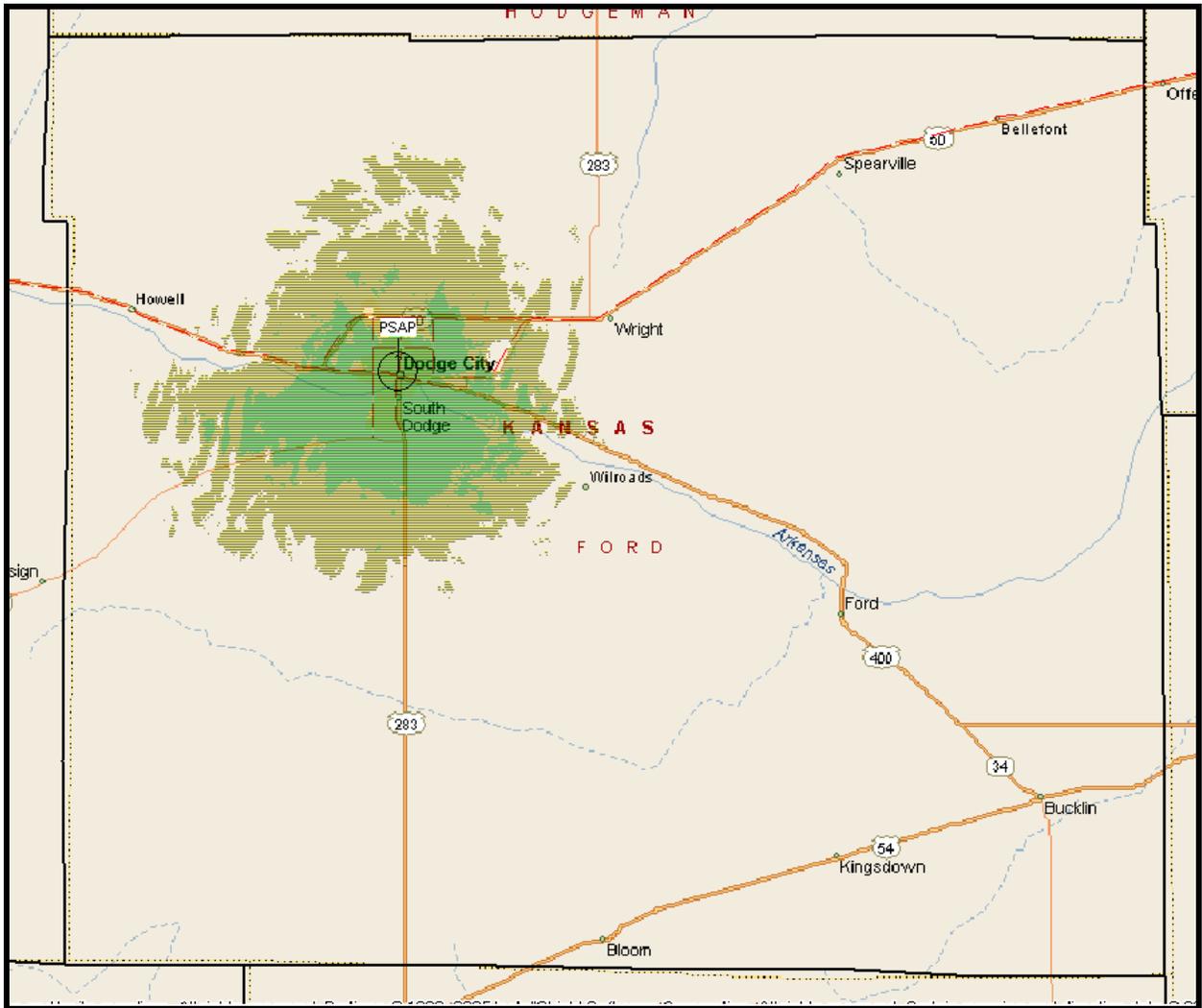
1.5 Coverage Analysis - Dodge City



**Effective VHF talk-out coverage from Dodge City site (100 Gunsmoke)
Also showing portable talk-in range**

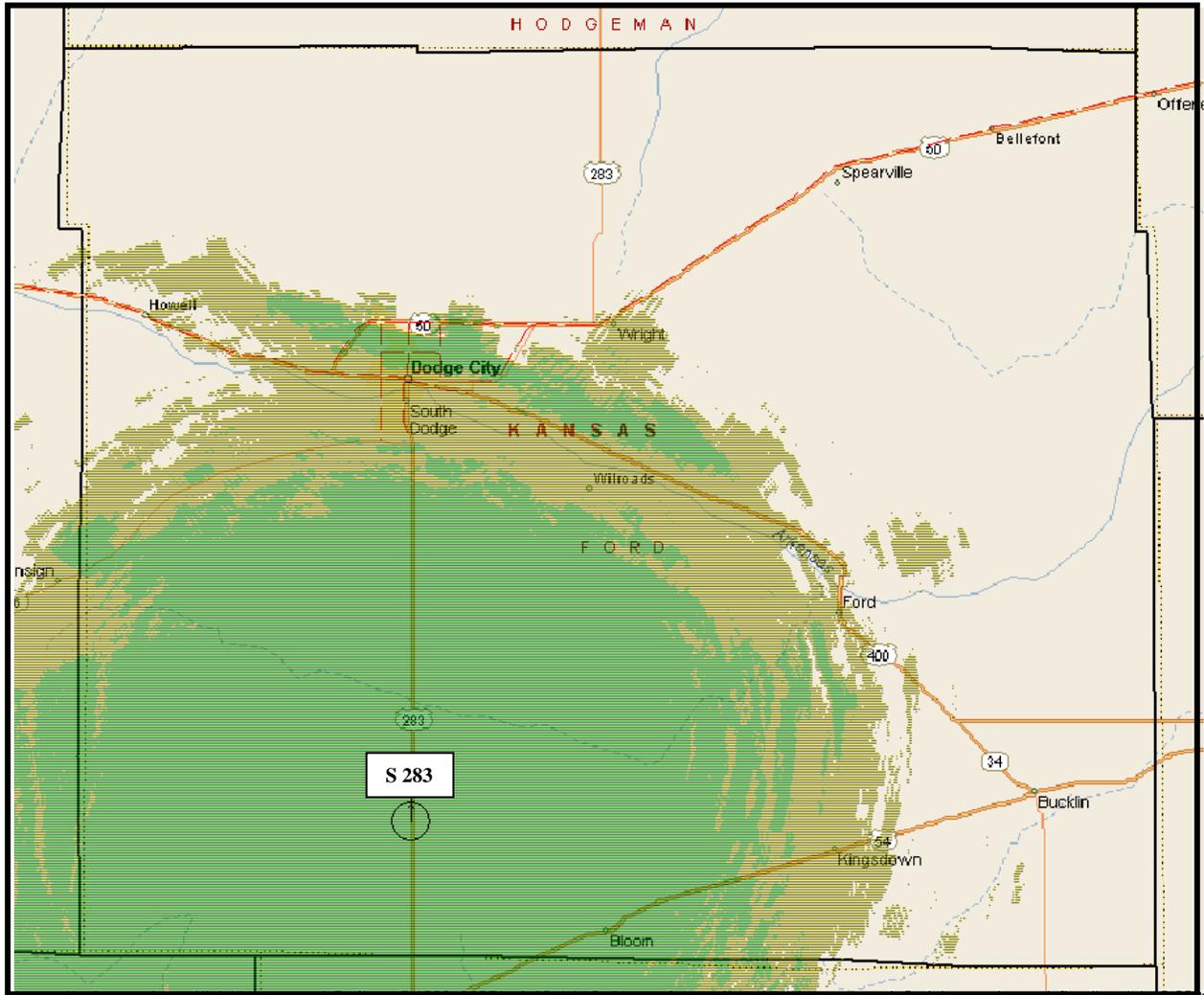
GREEN = portable-on-street coverage YELLOW = mobile coverage
Dotted RED line – effective portable radio talk-back (see next map)

Propagation analysis at VHF does not accommodate the impact of man-made structures. VHF does not penetrate structures well, nor does it “bounce” off surfaces due to the wavelength. Conversely, portable-in-building signals tend to stay within the building’s walls.



Effective VHF portable radio talk-in coverage in Dodge City

1.6 Coverage Analysis - Road & Bridge



Talk-out from South Highway 283 Tower Site (Road & Bridge repeater)

This site is supported by remote receivers at the MRT tower, Spearville, and Bucklin. The site's talk-out coverage does not reach Spearville or Bucklin (for portable use).

1.7 System Inspection

Inspect current subscriber radio inventory (mobiles, portables, control stations)

The Questionnaires provided the following radio inventory information:

Portables –

- Motorola HT750/1250, CP200 - VHF
- Kenwood TK7160H - VHF
- Motorola XTS1500 - 800 MHz
- Johnson portable - 800 MHz

Mobiles –

- Motorola PM1500 - VHF
- Motorola CM400 - VHF
- Motorola XTL1500 - 800 MHz

Pagers –

- Motorola MINITOR V - UHF

Control Station equipment used at the Dispatch center consists of various models of Motorola mobile radios interfaced to the Motorola Gold Elite Console Central Electronics Bank (CEB):

- CM400 - VHF
- CDM1250 - VHF
- XTL5000 Console (800 MHz)

Most of the VHF equipment being used is “commercial grade” versus “public safety grade” equipment. Public safety-rated equipment should comply with MIL STD 810 for ruggedness, IP67 for water immersion, etc. There is a cost premium attached to meeting these specifications. The current VHF equipment is in the \$800-\$1,500 per unit cost range. Public safety grade radios would be in the \$1,500 to \$4,000 cost range (for VHF, UHF or 700/800 MHz).

1.8 Meeting with User Agency Representatives

TCS met with the following department representatives on November 23, 2015:

- Dodge City Police Chief Craig Mellecker
- Dodge City Fire Chief Robert Heinz and Chief Kevin Norton
- Dodge City Public Works Superintendent Corey Keller
- Ford County Fire/EMS Chief Rob Boyd
- Ford County Sheriff Bill Carr
- Ford County Road & Bridge Director Chris O’Neal

- Ford County Emergency Management Assistant Director Mike Dunmars
- Ford County Communications Director Linda Smith

TCS presented a system overview based upon the propagation maps and using input from the user Questionnaires (as previously reviewed in Section 1.1 of this report). The participants acknowledged that the propagation maps were accurate as far as depicting system coverage. They also confirmed that the radio system was not providing acceptable County-wide coverage or in-building coverage, as was also reported in the Questionnaires.

Several issues were discussed:

- Coverage in Dodge City was better before narrowbanding and prior to moving the repeaters off the Central Avenue water tank. Narrowbanding could cause a perceived a loss of signal that is almost equivalent to turning the transmitter power down half-way. Water tanks are typically 120 ft. tall; the current Dodge City repeaters are on the rooftop of 100 Gunsmoke Street at approximately 90 ft. Both narrowbanding and the decrease of antenna height have impacted city-wide coverage.
- The Sheriff reported the repeaters in Bucklin and Spearville are not “user friendly” because when they are used, the deputy loses touch with other units in the County; only Dispatch hears the deputy. It is not known why these repeaters are not hard-patched to the main channel (always patched, not needing dispatcher intervention).
- Road & Bridge primarily uses mobile radios; analysis shows the system configuration does not support County-wide R&B portable radio use.

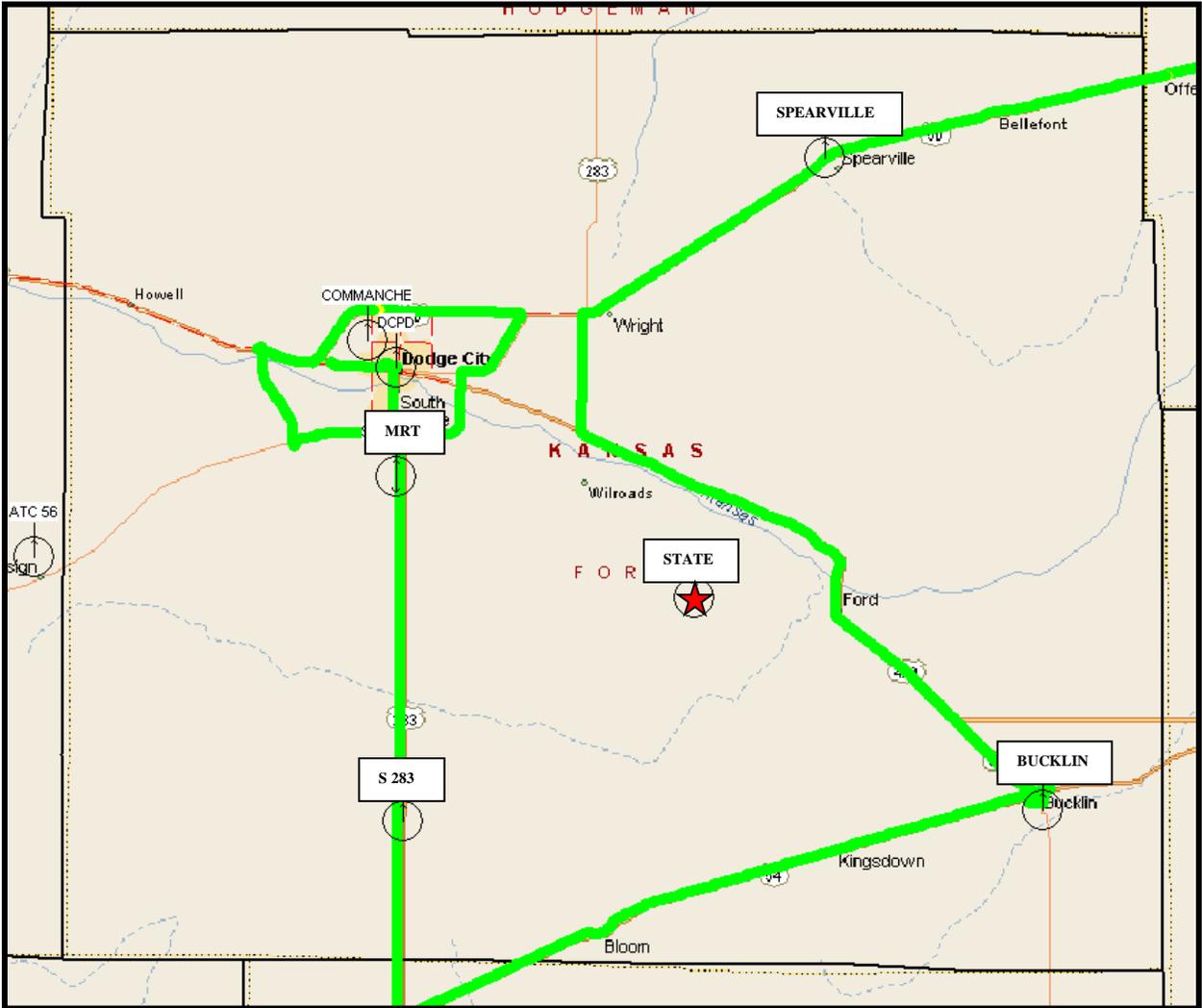
Further discussion addressed future needs and system configurations. This will be addressed later in this report.

1.9 County-wide drive test of the State’s 800 MHz system

As part of the TCS consulting services RFP proposal submitted to Ford County, an optional “drive test” of the State’s 800 MHz digital site within the County was described. The County opted to have this test conducted.

TCS utilizes specialized receiving test equipment to collect real-time signal coverage data; this equipment is primarily used to assess trunked radio systems that transmit a continuous “control channel” signal. This equipment records signal strength and GPS location, allowing it to be processed and overlaid onto a street map for analysis. The data can also be overlaid onto a propagation analysis map, allowing for a comparison of the actual drive tests results against the computer-generated coverage model.

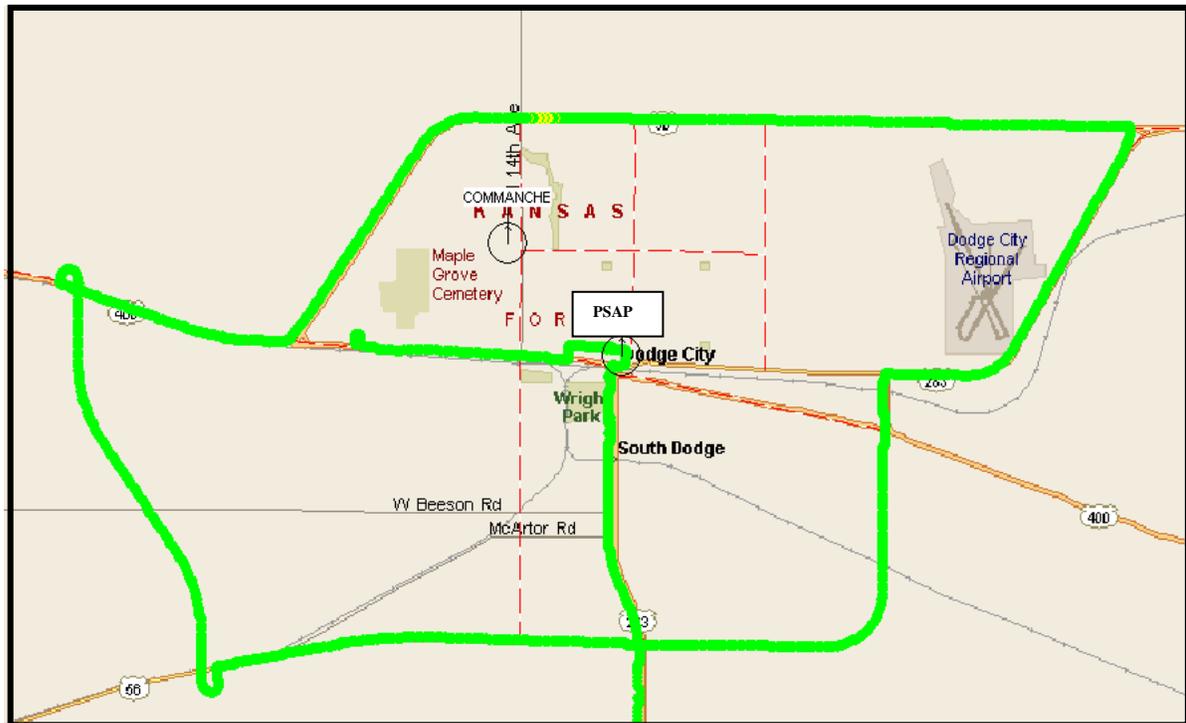
The following is the result of a drive test that was conducted on November 22, 2015. The route was selected to encircle the State site and specifically capture coverage in and around Dodge City.



Drive Test Result - State 800 MHz site coverage ★

GREEN = -90 DBM – equivalent to a portable on the street
YELLOW = -100 DBM – equivalent to a mobile radio

Signal level measurements indicate there is very good 800 MHz mobile and portable coverage in the central part of the County. Portable-on-street coverage should also be good in Dodge City, although the City is on the edge of portable coverage signal levels. It is not expected that reliable in-building coverage would be experienced within Dodge City from the State's site.



**Drive Test Result - Dodge City
PSAP - 100 Gunsmoke St.**

Coveraged within Dodge City is estimated to be satisfactory on-street, with some terrain blockage towards the north end of the City.

Some coverage into Ford County is provided by the Cimmaron State site to the west (in Gray County) along Highway 400. Coverage is minimal, at best, and is not useable for reliable portable coverage within Ford County.

The State's design goal target is to cover the main highways for a mobile user (State Patrol or KDOT) and it appears to meet that goal.

TASK – 2 - RECOMMENDATIONS

2.1 Develop system improvement recommendations: upgrade of VHF system, transition to digital technology, etc.

Current VHF System

Users reported that there are two major issues with the current VHF radio system in the County:

1. Wide-area coverage – portable radio-based
 2. In-building coverage
- *Even considering the impact of narrowbanding, the County's VHF radio sites are not capable of providing County-wide coverage. The configuration was probably acceptable in the past when higher powered mobile radios were used and there was no expectation that a portable radio should work everywhere. The current network with remote receivers provides some portable coverage improvement, but analysis and user input confirms that the current VHF repeater sites do not completely coverage the County.*

The following is a review of the above two issues:

1. Wide-Area Coverage

Public safety first responders expect their portable radios to work wherever they need to be used. Today's modern public safety radio networks are designed with the "portable-on-hip" as the standard.

Several respondents mentioned performance has suffered as a result of the recent "narrowbanding" of the VHF system to comply with the FCC's 2013 mandate to utilize a 12.5 KHz bandwidth. The intention behind the narrowband mandate is to "create" more radio channels by reconfiguring a limited resource. While the theory is sound, the immediate result was an apparent loss of coverage. Narrowbanding effectively reduced talk-out and talk-in range as a result of reducing the radio channel's bandwidth.

A narrowbanded frequency modulated transmitter's audio is decreased to fit within the 12.5 KHz channel and a receiver's selectivity is restricted to only "hear" within that narrow channel. The result is lower detected audio and the potential for increased noise. An analogy would be hearing a person speaking in a normal voice level across a room and then trying to hear them whispering from the same location.

In some cases, the "loss of coverage" could equate to a loss of 3 dB of signal coverage, or almost half of what had been previously experienced. In systems where

the range was “adequate” it became “unsatisfactory” after narrowbanding. And, especially at VHF, narrowbanding only highlighted some of the band’s inherent issues: susceptibility to electrical noise, more sensitivity to interference, atmospheric disturbance (“skip”), and poor in-building signal penetration. TCS was advised that certain VHF channels in the County are also being impacted by “pulsing noise” generated by high-voltage electrical transmission line/data applications.

Simulcast Systems

One of the more-effective methods used to re-gain pre-narrowbanding coverage at VHF is to deploy a “simulcast” network (SIMULTaneous broadCAST) that uses multiple sites that transmit at the same time on the same frequency. Simulcast technology is used very successfully in wide-area analog and digital trunked systems in the 700/800 MHz bands. Simulcasting of VHF channels requires that the channel be “clean” as far as FCC licensing is concerned. That means the channel must be capable of being licensed at all of the simulcast sites. This significantly expands the “contour” of the channel in regards to interference protection from users of the same frequency in the next county, next state, etc. In the VHF band, this sometimes is a roadblock to deploying a simulcast system. The major issue, however, is that after spending a lot of money to deploy a simulcast system, the same VHF band issues remain – susceptibility to interference from co-channel users, atmospheric disturbances, electrical noise, and poor in-building signal penetration, coupled with limitations on available frequencies to accommodate public safety needs.

2. In-Building Coverage

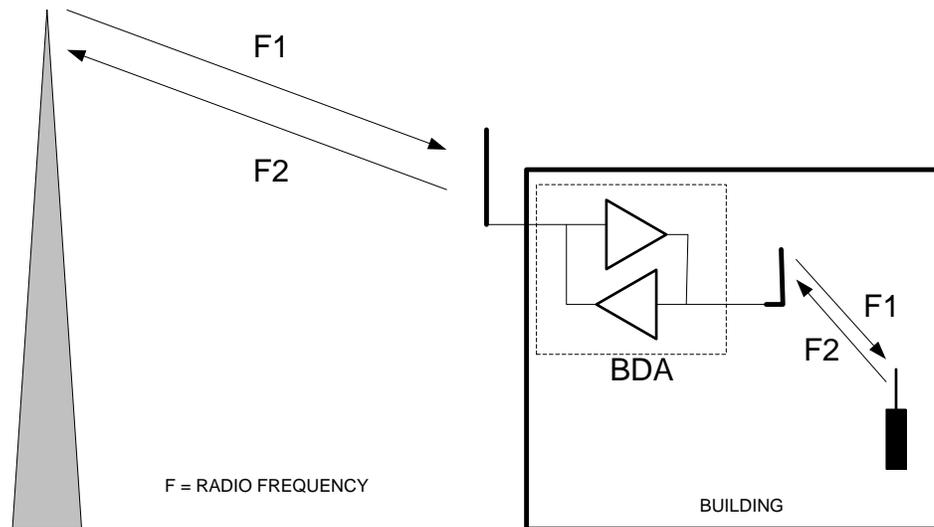
There was a consensus amongst Questionnaire respondents that portable radios do not work within many buildings in the County, especially the buildings that are within the core of Dodge City. This is attributable to the VHF’s band’s wavelength which cannot penetrate walls or enter buildings through windows and doors. This is why large city systems operate in the UHF (450 MHz) and 800 MHz bands – due to their shorter wavelength, these bands do a much better job of traveling down streets and alleys, and penetrating buildings; and, once inside, the signals bounce off walls and ceilings all throughout the building. It is expected that in Dodge City in-building coverage was a problem pre-narrowbanding, but it became more evident after narrowbanding. Users reported that in-building coverage was better before the main repeaters were moved from the City Water Tank (120 ft.) to 100 Gunsmoke Street (90 ft.).

Bi-Directional Amplifiers

There are technologies available that can improve in-building coverage. The most popular application is that of the bi-directional amplifier (BDA). A BDA receives an outside signal and retransmits it inside on the same frequency, and vice versa. A portable radio user can enter a building and continue to communicate without

having to switch channels on their radio. BDA's are very popular in the 800 MHz band (for cellular and public safety) because they are economically reasonable to deploy. BDA's for VHF are rare and expensive.

BI-DIRECTIONAL AMPLIFIER (BDA) APPLICATION

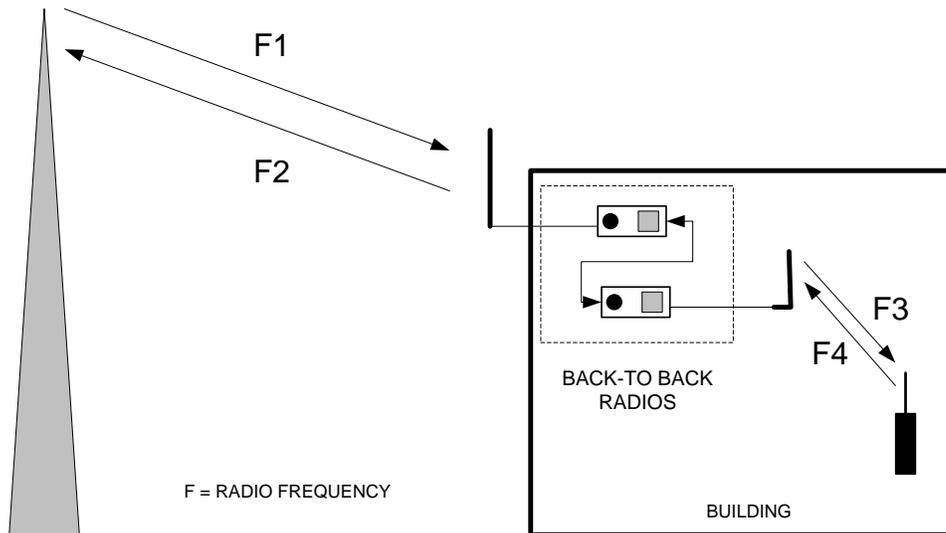


The VHF band's repeater channel assignments do not follow any specific "rules" regarding transmit and receive channel spacing. As a result, VHF BDA's have to be custom-designed for each application. Extensive signal processing/filtering is required to make the BDA effective. BDA's for VHF can cost in the range of \$30,000+, while 800 MHz BDA's cost around \$3,000+. It is impractical and not economically feasible to consider using BDA's to resolve VHF in-building coverage issues on a wide scale.

Back-to-Back Repeaters

A more cost-effective, but operationally-unpopular method to improve in-building coverage at VHF is to use "back-to-back" radios that receive the outside signal and retransmit it internally on a different frequency. The reverse would be the same for receiving the inside signal and retransmitting it outside. This requires the portable radio user to switch to the "inside channel" to be able to communicate. These types of systems have limited use in locations where the user might use the radio primarily "inside" than outside but has a need to be in contact with Dispatch; for example, back-to-back radios have been used in schools and hospitals. These configurations are relatively inexpensive to deploy. However, for an itinerant user, this type of system is not very effective.

BACK-TO-BACK RADIO APPLICATION



VHF System Upgrade

- *It is expected that the FCC will be issuing another “narrowbanding mandate” in the near future. This will require radio systems in the VHF and UHF bands to be capable of operating in a channel bandwidth of 6.25 KHz (half of the current 12.5 KHz). Current analog FM radios are not capable of operating within a bandwidth of 6.25 KHz. The only technology that can accommodate that type of bandwidth is “digital”. TCS advises the County to carefully consider expending funds on current-system improvements; the investment might be short-lived. Additionally, it is TCS’s experience that digital VHF systems are not suitable for portable-based systems and a VHF digital system would still be impacted by co-channel interference, atmospheric anomalies, electrical noise, and limitations to available channels.*

TCS recommends the County investigate configuring the Spearville and Bucklin repeaters to be “hard patched”. This would provide improved County-wide performance for the Sheriff’s deputies.

It should also be possible to connect the Jail repeater to the dispatch console system via a wireline connection or a control station.

There is no simple solution to Dodge City’s issues aside from deploying a new radio system that is capable of addressing the City’s portable and in-building coverage challenges. A single 800 MHz P25 site would bring about noticeable improvement. TCS recommends that the 800 MHz site be located within the City core (such as at the Heartland tower at Comanche and 14th).

2.2 Provide coverage maps based upon conceptual designs

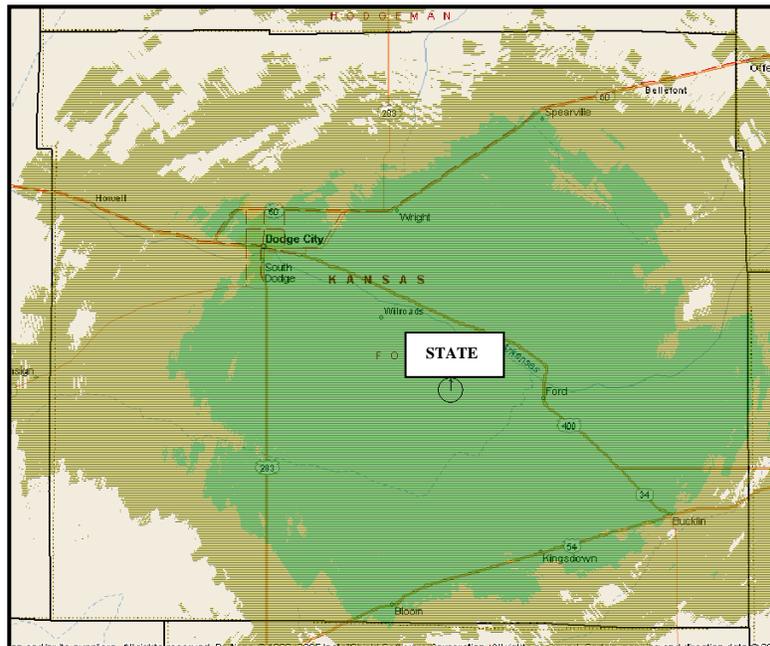
TCS is proceeding with a recommendation to transition to a County-wide 800 MHz P25 system solution. A County-wide simulcast VHF system would cost about the same as the 800 MHz network – the only difference being the need for new subscriber equipment for the 800 MHz system. (Current VHF radios cost \$800-\$1,500 – P25 700/800MHz radios cost \$1,500-\$4,000.)

The County has an option to “join” the State P25 800 MHz system by adding sites to the current State site and creating a County-wide simulcast system; this locks in Motorola as the system infrastructure provider since the State’s Motorola Core site would be used to operate the County system. This scenario has been followed by Butler, Shawnee, Leavenworth, Douglas, and several other counties in the State. However, there are other P25 800 MHz system options that the County should consider. For example, Sedgwick County built a stand-alone Cassidian P25 system, and Wyandotte County deployed a stand-alone Motorola P25 system that has been integrated into the regional MARRS network.

800 MHz Design

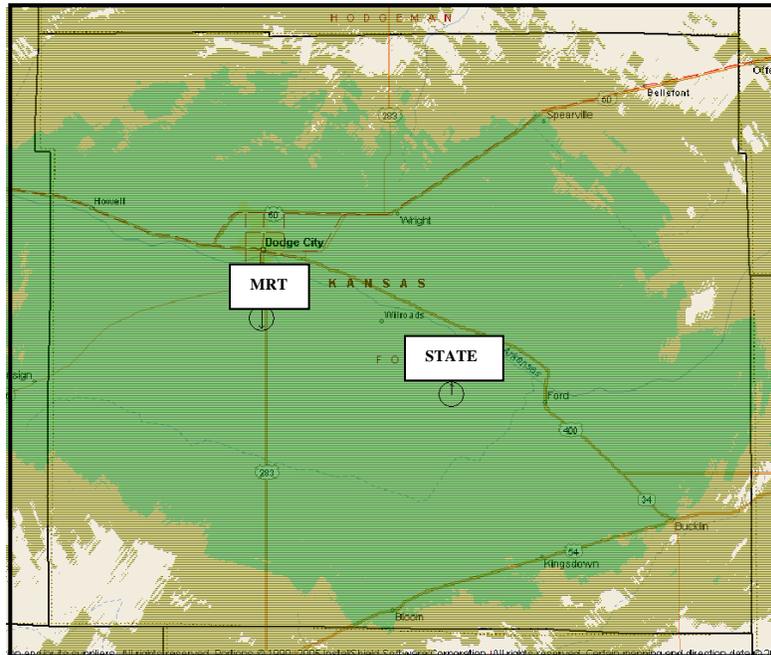
The first task is to assess the overall coverage that is needed to make a P25 800 MHz deployment effective. The following coverage maps illustrate the design process used to determine the optimum configuration.

This map shows the coverage currently provided by the 800 MHz State site:



Current Coverage from State site

The next map shows the addition of an 800 MHz site to the MRT tower and the resulting aggregate simulcast coverage:

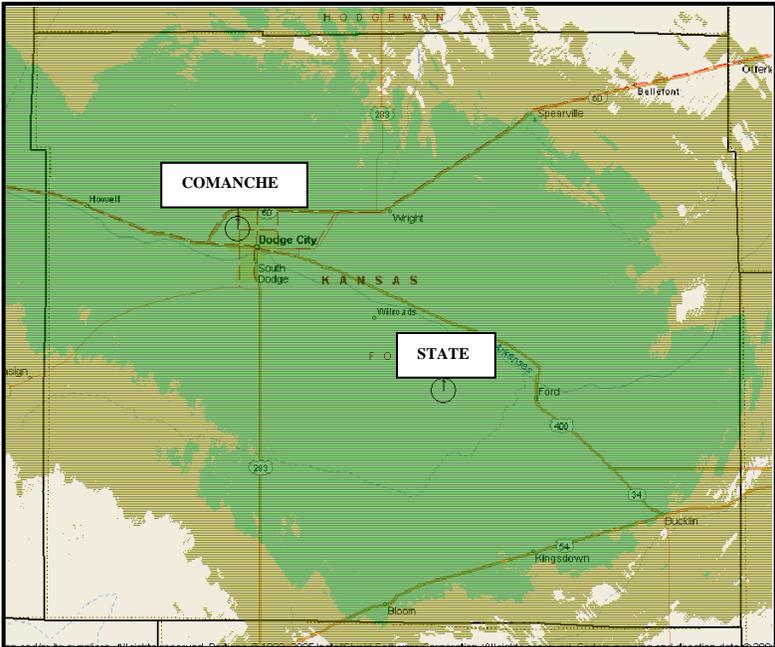


Coverage from State and MRT tower sites

The TCS design philosophy places sites where they provide the best return on the investment. That includes placing sites “in” the area where coverage is needed, not outside of it. Since a site in the south central part of the County will be needed, it is best to get the most coverage out of each site in the design than to have a large amount of overlap which would be the case if the MRT and South 283 sites were used.

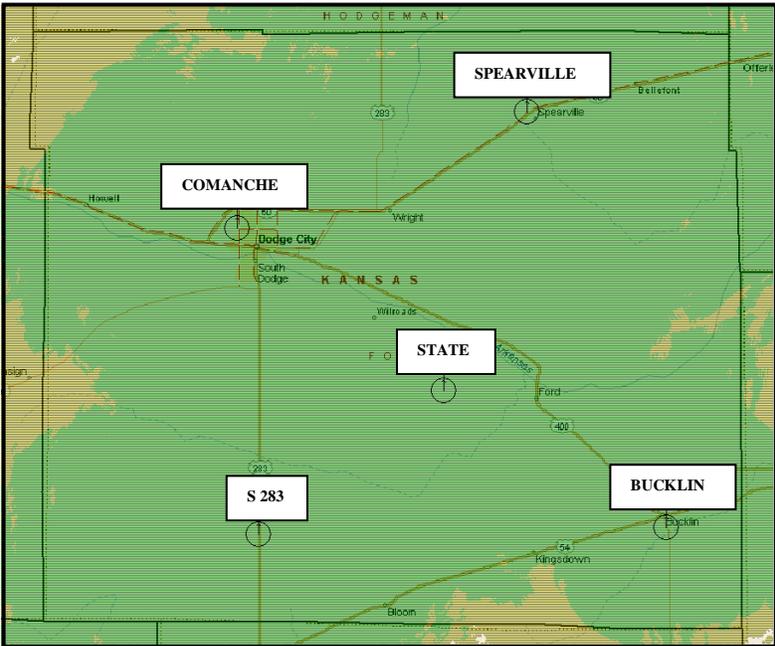
The next map shows a site placed on the Heartland Tower located at Comanche and 14th in Dodge City. The MRT tower is approximately 5 miles from the center of Dodge City. The Heartland tower is a mile away from the City center. TCS has confirmed that the top of this tower is available for new antennas and that the tower can accommodate future microwave dishes.

TCS also assessed coverage from the Central Avenue water tank. The site does not have enough height to be effective.



Coverage from State and Heartland tower sites

The next maps shows the final conceptual design, using a total of five sites.

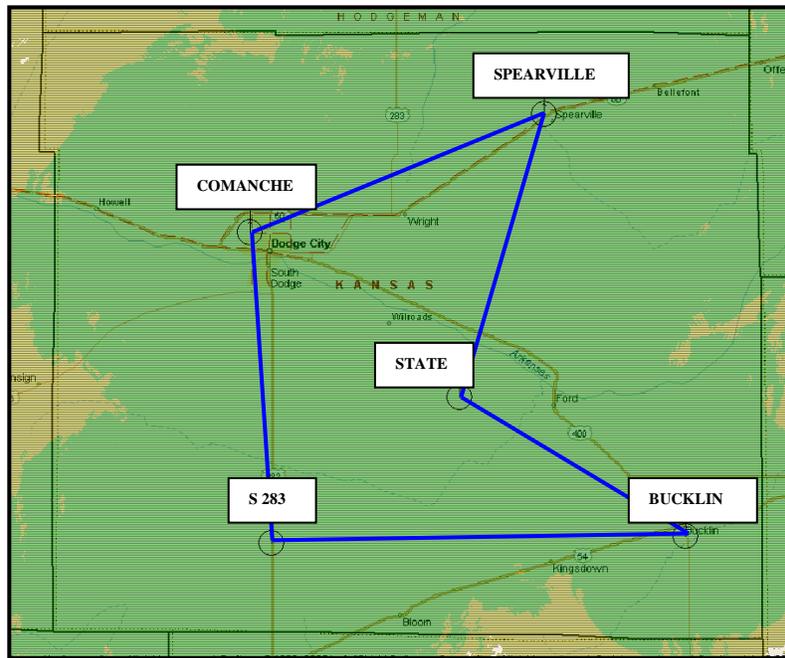


PROPOSED COUNTY-WIDE 800 MHZ P25 SYSTEM

The proposed 5-site County-wide design utilizes three (3) sites that the County currently occupies: S. 283, Spearville and Bucklin. The State and Heartland tower sites would require leases/negotiations for equipment and antenna space. The County would eventually move off the MRT tower.

TCS proposes that the system be interconnected with a high-capacity IP-based microwave network in a “loop” configuration that provides a high level of reliability. If any site-to-site microwave link “breaks”, the 5-site system still operates around the remainder of the loop.

A “point-to-point” microwave link from the Comanche tower would connect the system to the PSAP (not shown).



— = microwave paths

The proposed system would utilize a trunked network design; every site would have the same number of available channels to automatically serve offered calls. It is estimated that six (6) channels would be sufficient for all County and Dodge City traffic. A six (6) channel system could accommodate 600 radio users.

TCS is advised that cellphone coverage across the County is not consistent, carrier-to-carrier. The proposed 5-site public safety system would actually provide more reliable County-wide coverage than the cell networks.

If Dodge City were to deploy its own 800 MHz P25 radio system, a standalone “multi-site” P25 trunked configuration controlled by the State’s Core would be a

viable solution. The site could eventually be integrated into the proposed County-wide network. Channel access priority could be used to ensure public safety access over other agencies on the network.

2.3 Submit a Final Report to the County including the recommendations and estimated costs of each design

TCS offers the following recommendations in regards to the current radio network and future network for Ford County:

1. **Short Term:** If feasible from an operations standpoint, the County should investigate the potential to hard patch the Spearville and Bucklin VHF Sheriff's repeaters into the main dispatch channel. Any traffic on any repeater would be heard by all users on either the main Sheriff's repeater channel, or the Spearville or Bucklin repeaters. This scenario can be presented to Mobile Radio for their input and cost estimate. The result would be better County-wide coverage for the Sheriff's deputies, even though such a "multi-cast" configuration is radio-spectrum-inefficient.
2. **Mid-Term:** Pending identification of funding for a County-wide P25 800MHz system, Dodge City could move forward with deployment of a city-based P25 800 MHz site that could be integrated into the County-wide system in the future. The site would be located at the tower at Comanche and 14th. This would address the City agencies' issues with coverage and reliability. Talkgroups on this trunked site would be hard-patched to the Sheriff's and Road & Bridge VHF channels, etc., allowing for automatic cross-system communications capability. This would be no different than today when each agency essentially operates on their own channels and switches to each other's channels if necessary.

A 6-channel stand-alone Dodge City P25 800 MHz site would cost approximately **\$650,000**, less the cost of subscriber equipment, site acquisition, and any construction costs for equipment space. This cost includes the point-to-point microwave connection from the trunked site to the Dispatch center, and the vendor's engineering and project management costs, installation services, etc.

3. **Mid-Term:** Concurrent with the Dodge City upgrade, the Dispatch center should upgrade the existing five (four?) radio consoles to be compatible with the P25 digital site and future County-wide system. This new equipment would also be backward compatible with the legacy VHF system (Sheriff and Road & Bridge). A budgetary number for this upgrade is **\$450,000**.
4. **Long Term:** The final design, a County-wide P25 800 MHz system could cost approximately **\$5 Million**, including the IP microwave network. This assumes the proposed P25 Dodge City site is already operational and the

Dispatch consoles have been upgraded. A competitively-bid RFP could drive this number down significantly. Subscriber equipment upgrades, new portables and mobiles, are not included in this cost. For budgetary purposes, assume \$3,500 per unit. With an initial subscriber count of 300 units, the P25 800 MHz subscriber equipment would cost approximately \$1 Million. Competitive bidding would drive this number down.

5. Paging - If the County moves forward with the County-wide 800 MHz P25 digital design, a simulcasted conventional UHF paging system can share the five sites and the microwave system. It would provide more than adequate coverage to a pager across the County. It would cost approximately **\$175,000**. Depending upon the number of pagers being used, it might make more sense to spend that money on the new P25 800 MHz pagers that are supposed to be available in 2016.

The next VHF/UHF narrowbanding mandate is not expected to happen until after 2020. By that time, the County could have already transitioned to the new P25 digital pagers on the 800 MHz system. Therefore, the 2020 mandate would not be an issue for the County since all County services would be at 800 MHz.

A “phased-in” Dodge City P25/Dispatch upgrade and later P25 County-wide system deployment transition would bring with it some extra costs due to “remobilization” of the vendor’s resources. This would be dependent upon the timing between deployment of the Dodge City/Dispatch system and the final County-wide network.

The budgetary numbers provided are “worst case” based upon recent RFP pricing submittals for similar projects. With five major companies now active in the P25 system marketplace, pricing is becoming very competitive. For example, a recent TCS project for a new 9-site P25 system resulted in bids that ranged from \$14 Million to \$8 Million – a significant spread.

While Harris and Motorola continue to offer systems based upon centralized “control points”, other vendors such as Cassidian/AirbusDS, E.F. Johnson and Tait are offering systems with more-modern distributed control architectures. These newer systems are significantly less expensive. The Harris and Motorola configurations add \$600,000 to \$1,000,000 to the cost of a system just for the “core/control point” equipment. This equipment is not required with the other vendor’s distributed architecture configurations.

If the County elects to move forward with a partnership with the State, this Core cost would not be an issue since the State would provide the Core equipment/application. However, it is possible that the State might impose annual “maintenance fees” to support provisioning of the Core infrastructure. It is very important to note that the maintenance costs of P25 digital systems are significant,

ranging from tens-of-thousands of dollars, to hundreds-of-thousands of dollars per year.

The actual cost of the above configurations would be best determined by issuing a Request for Proposals (RFP). TCS has developed very detailed RFP's that clearly define needs and performance expectations. A comprehensive RFP is to the client's and the vendor's benefit.

2.4 Present findings and recommendations to the Ford County & Dodge City

TCS is available to review this report at the County's & Dodge City's convenience and to discuss "next steps".

SUMMARY

Ford County and Dodge City are operating legacy VHF radio systems that have been impacted by narrowbanding and other system changes. The systems do not provide County-wide portable coverage or modern public safety radio system features, and much of the system infrastructure is approaching its end-of-life. Tusa Consulting Services has been retained to assess the current systems and provide recommendations for system improvements/upgrades.

TCS believes it would be in the County's best interest to pursue an upgrade to the public safety open standard known as APCO Project 25, or "P25". A County-wide 5-site design has been proposed that would provide better than 95% portable-on-hip coverage throughout the County and in Dodge City.

A transition/upgrade process has been proposed that would "phase" in the upgrade over several years, if necessary. TCS can work with Dodge City and the County to develop a detailed "phased" approach.