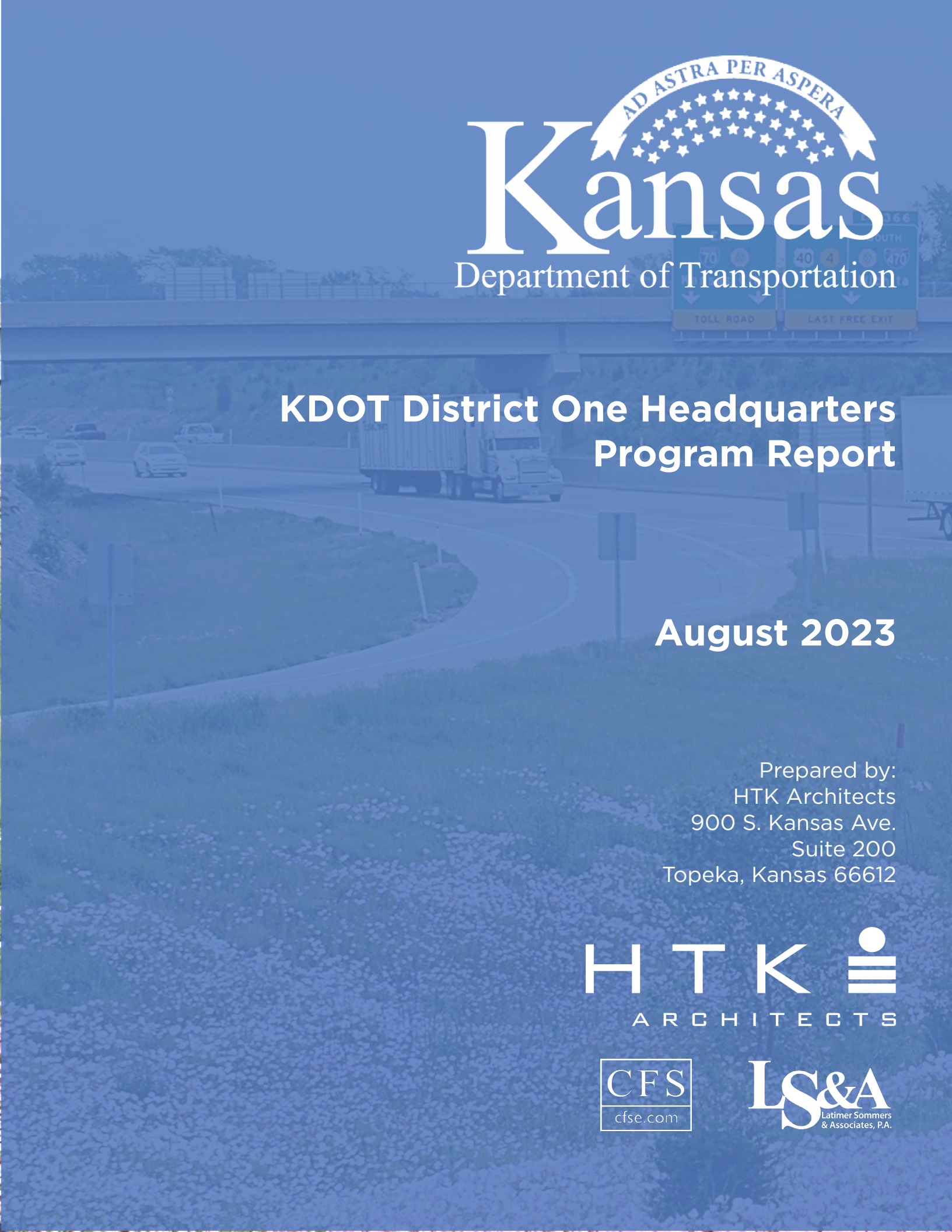

Kansas
Department of Transportation

KDOT District One Headquarters Program Report

August 2023

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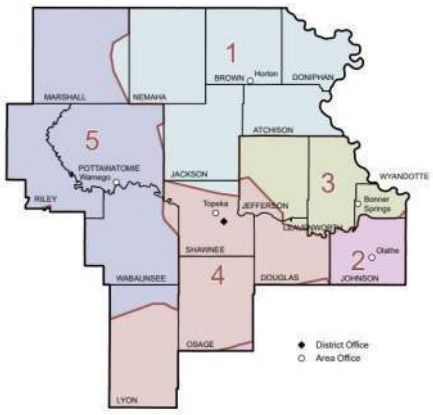
Statement of Need

The Kansas Department of Transportation commissioned HTK Architects to perform a building programming study and concept design for the proposed new KDOT District One Headquarters located in Topeka, KS. The design team was tasked to meet with users to develop the facility's functional program and spatial adjacencies and perform a preliminary review of sites. This document will establish the building and development program for a phased relocation of the current headquarters, maintenance facilities and materials lab to a new location.



KDOT District 1 is responsible for the construction and maintenance activities for 17 counties in northeast Kansas covering over 5,704 miles of state highways within the district. The headquarters manages major maintenance, repairs, and preparation of district vehicles, administrative duties, and parts and supplies distribution throughout the district.

The District 1 Headquarters currently conducts operations at the north facility located at 121 SW 21st Street, Topeka, KS which appears to have been built sometime in the first half of the 20th century. Various additions have been constructed through the years. The operations and site have outgrown the current facility. Existing facility challenges include the following:

- Vehicle sizes have outgrown bays and openings
- Limited wash bay capabilities
- Limited machine room, welding room, and engine rebuild room
- Site has limited space for vehicle storage, parking, and auction storage
- Site has congested traffic that crosses large and light duty vehicles and fueling
- Limited street access in residential neighborhood
- Limited fencing for securing outdoor equipment
- Multi-level parts storage that limits parts and supply storage
- Small and difficult dock
- Lack of flexible meeting space
- Lack of administrative space
- Lack of records storage space
- Outdated building support space and systems

The new facility would provide appropriately sized work bays, proper shop support space, flexible parts and material storage, flexible administrative space with room for growth, additional meeting space, and additional records storage. The site will provide separation of traffic for various vehicles, appropriate paved areas for maintenance vehicles, parking, and auction storage, separation of fueling facilities, and fencing for increased site security. Convenient highway access is critical as the facility not only serves KDOT vehicles but also fueling for State High Patrol vehicles and other State vehicles.

Site

The study included evaluation of two potential sites that KDOT owns and is in the process of acquiring additional land adjacent to I-70. Both are located near SE 21st Street and SE Rice Road on the eastern edge of Topeka, KS. Design considerations included site size, access, utility availability, topography, and stormwater management.

Process

HTK developed the program through information gathering, space evaluation, and facility comparison. Meetings were held with building users to gather information including space type, area, and quantity. The existing building was evaluated to determine the challenges and limits to the users' needs and the compromises that have been made to work with the facility. Through tours and discussion, the program was compared to other facilities of a similar nature in order to develop concepts that will work best for the District 1 Headquarters. Several building and site options were developed to create an appropriate concept design.

Building Program:

Space Descriptions

The program is divided into two functional areas: a shop space with work bays, supply space and supporting functions and a separate but closely located administrative area.

Shop

Work Bays: The facility needs 12 workspaces for heavy duty vehicles and 2 workspaces for light duty vehicles. The heavy-duty spaces will primarily serve snowplows with dimensions of approximately 9 feet wide by 35 feet long (depending on position of plow) by 11 feet high. The overhead door height must be a minimum of 14 feet wide by 12 feet high, but this does not allow for potential future vehicles. It is preferred that the bays are set up as pull through to allow flexibility of vehicle length and trailer attachments. A wide aisle central aisle is preferred. The light duty bays will service a maximum vehicle size similar to a Ford F250. Over the years heavy duty vehicles have only become larger so it is likely that pattern will continue within the limits of existing traffic ways. The bays need to be large enough to accommodate vehicles, working space, equipment circulation, egress circulation, tools, and workbenches. The existing two post and four post lifts will be moved to the new facility for the light duty bays. This will need a three-ton crane with 18-foot hook height that serves multiple bays. The shop will not have a central vehicle exhaust system. Portable units will be used with ports in the overhead doors.

Tire Area: This area needs to be 1.5 times larger than its current space. There will be a tire changer, wheel balancer, and tire bath, as well as various smaller tools. This is used for light duty tires and should be near the light duty work bays. This can be open to the shop space.

Engine Rebuild and Tool Storage: This will serve as a 'clean' room separated from the main shop space by walls. A large overhead door is needed to the shop and to the exterior. It will house shop tools, minor parts like bolts, and manual library. This should be the size of a light duty bay. This space will need a one-ton jib crane.

Welding Shop: The shop needs to be a minimum of 40 feet by 60 feet but 50 feet by 60 feet is preferred. This room will be enclosed separately from the shop to limit cross over of fumes and dirt. A

wide overhead door to the exterior is preferred to move long materials in and out with a forklift. A five-ton crane is needed in this space with an 18 foot hook height. Several different ways to exhaust fumes have been discussed. It will likely be best to use a portable fume extractor rather than a single point of use or venting the entire space.

Wash Bays: Two wash bays are needed and should be sized to wash heavy duty vehicles. One wash bay will be for everyday use the other bay will primarily be for the paint sprayer vehicle. The paint sprayer will be parked in this bay as well since it needs to be in a climate-controlled environment in the winter months. The wash bays need to be separated from other spaces but can be open to each other with a wash curtain between them.

Shop Support: These are the administrative spaces directly related to the shop. This includes offices for the shop supervisor, shop superintendent, and shop administrative assistant. There are several large filing cabinets in the current space that need to be accounted for in the new. A crew room is also needed. This will be a break room and meeting room space. Approximately 8 lockers will be needed for employee items and it is preferred to have some changing rooms near these. These areas should be connected to the shop or easily adjacent.

Facilities: This area includes the office space, crew room, equipment storage, and vehicle storage for the facilities staff. These staff maintain buildings and grounds in district 1. The office space is for the facilities supervisor. The crew room is a break room and meeting room space for the facilities staff. This needs at least 3 lockers. The equipment storage will be for storing tools, minor parts and supplies, and equipment like lawn mowers. The vehicle storage will be for storing at least two light duty vehicles, the largest of which is a Ford F250. If possible, it would be nice to store two additional IT vehicles in this garage area. However, it is not necessary if these vehicles can be parked in a fenced area.

Purple Wave: This area will be for the storage of auction items. That needs to be in an interior environment. This area will need to be easily accessed from the main entry to bring buyers to review items. Some caging is likely needed to separate types of items. This can be a separate standalone building.

Supply: This area is managed by NAPA and includes a large supply storage, office space for six people, a secure area of delivery pick-up, and a service window. The supply area includes vehicle parts, maintenance supplies, building supplies, and custodial supplies. The office area functions as a call center for the district shops. This needs an open office area and one private office. The internet and phones will be separate from the main building. The service window will need to serve the district 1 shop and employees from area shops. A large monitor is used for parts tracking. NAPA needs a computer desk area, service counter with window, and a printer area. The delivery pick up area will be a secure location accessed from the dock that supplies can be picked up from. NAPA staff prepares the supply packages, and these are picked up overnight. The dock needs to be able to accommodate a semi-truck and trailer. The dock area needs to be approximately 20 foot by 20 foot to accommodate large signs.

Shop Building Support: This encompasses all the spaces that are needed to run the building including mechanical/electrical, data, shop equipment, custodian, and restrooms. The mechanical/electrical room size will be dependent on the HVAC system and electrical panels needed. The data room size should be 10 feet by 15 feet. The restrooms will be sized per code. Through meetings it has been determined that single use restrooms will be the best option since there is a higher proportion of male to female staff. One restroom should have a shower. The custodian area needs to house basic cleaning supplies and should account for a future floor scrubber machine. The shop equipment room will house the compressor and any other system equipment to run the shop. The

users did not want a central oil dispensing system. A generator is also needed with the size to be determined.

Exterior Components-Shop: Equipment parking is needed for approximately 20 heavy duty vehicles. This will include vehicles in queues for maintenance and new vehicles needing to be outfitted. An area for exterior auction items is needed. This should be fenced separately from the main yard. A fuel island or islands is needed. This will serve light duty vehicles from other state agencies and heavy-duty vehicles on site for maintenance. Ideally the light duty fuel island is easily accessed from a site entry point and away from other functions. There should be at least eight parking stalls within the fenced area for KDOT vehicles that are parked overnight. A combined personal vehicle parking lot for approximately 60 cars is also needed. This also accounts for vehicles from the administration. The majority of the maintenance yard area will be fenced in with chain link fencing on the non-street side and a decorative type fence on the street side. An equipment testing area away from the building site is needed. This area needs to be cleared and relatively flat but not paved.

Administration

General: The best layout for the administration area will be office suites with open office and common entries surrounded by private offices. The suites should be separated into departments. Refer to the programming spreadsheet for further details.

Director and Engineering: There are nine staff personnel in this area. This department will consist of the district engineering, surveyors, construction engineers, and safety specialists. A common space with the senior administrative assistant and then five private offices. The district engineer office needs a small meeting area. Several offices will have space for more than one person. The office receptionist will be located near the front entry and have a small waiting area.

Public Affairs, Human Resources, and Accounting: There are nine staff personnel in this area. This will include an additional six open offices for future personnel. Accounting will be in its own suite. Human Resources will need to be in private offices. The future personnel area will be flexible space that can serve as additional meeting space. HR and Accounting will need access to a storage area that can be in a centralized location secured from other storage.

Information Technology: There are three staff personnel in this area. In addition to office space a workroom space is needed for technology maintenance. This space should have perimeter countertops at similar height to current counters in the range of standing height.

Conference and Training: The large conference/training room will need space for around 100 people. This room will be for staff meetings, training and testing, and public meetings. The room needs to have a flexible setup with multiple monitors for presentations and access to electrical outlets for laptop charging. A small kitchen area closed off but adjacent to the training room is needed. Room should have a fridge, sink, and counter space for food and drink preparation. In addition to the large conference room an administrative conference room for 12 people and a small conference room for 4 people will be included. The 12-person room can double as an additional testing room.

Storage and Office Support: A private nursing mothers' room will be included. A breakroom with refrigerator, microwaves, and sink plus room for seating will be included. Ideally this room will be near the outdoor break space. An administrative work room is needed. This room will be for a printer/copier,

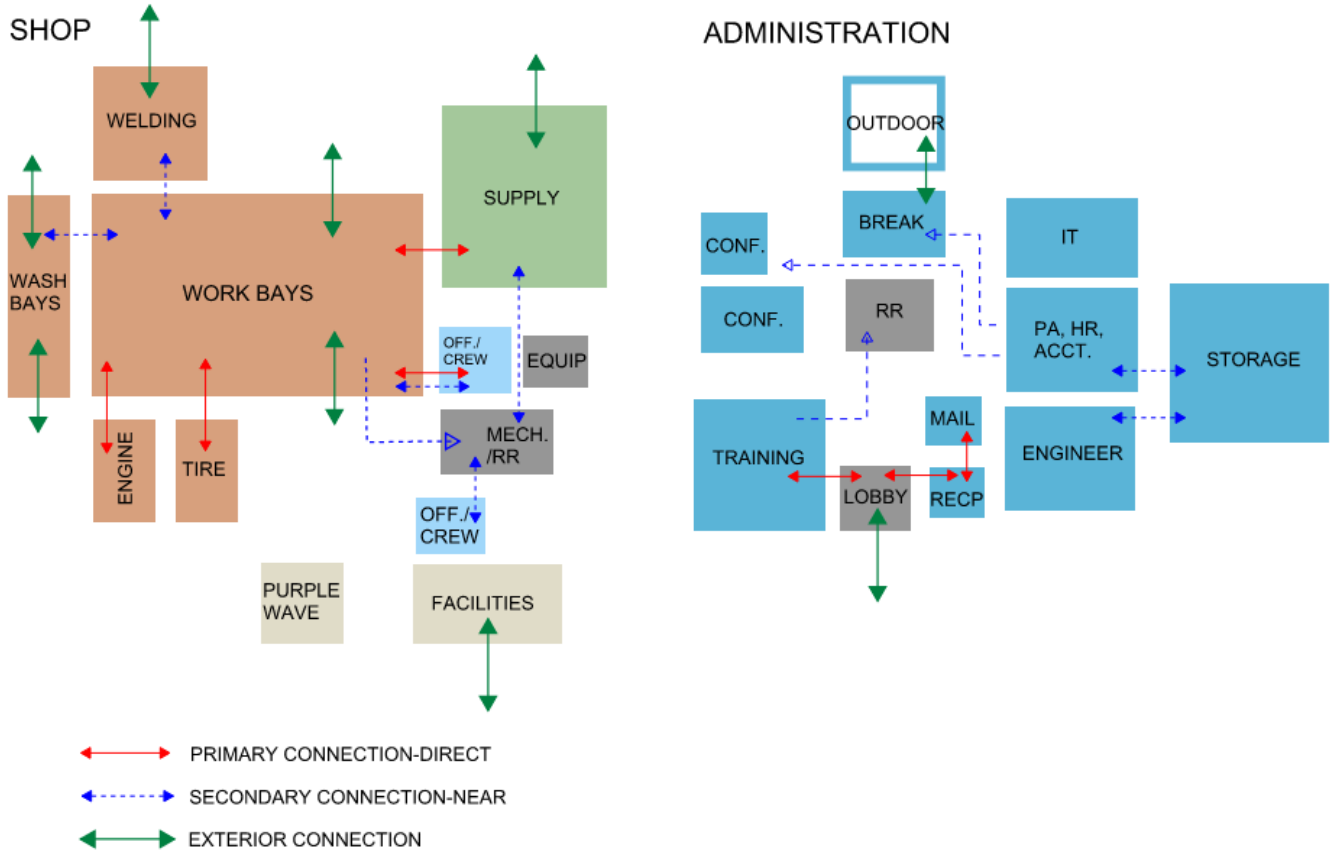
storage of files and office supplies, and mail sorting. A large room is also needed for plan file storage. This includes large drawing plans, books, and file storage.

Administration Building Support: This area includes spaces that support the building infrastructure including mechanical/electrical, data, custodian, and restrooms. Restrooms will be sized per code. Ideally the mechanical/electrical and data rooms can be used as extensions of the main building support rooms with the shop area. The custodian space will hold minor cleaning supplies and equipment.

Exterior Components-Administration: The personal vehicle parking is accounted for in the shop exterior components. An outdoor gathering/break area is preferred. This area should have shade and be landscaped.

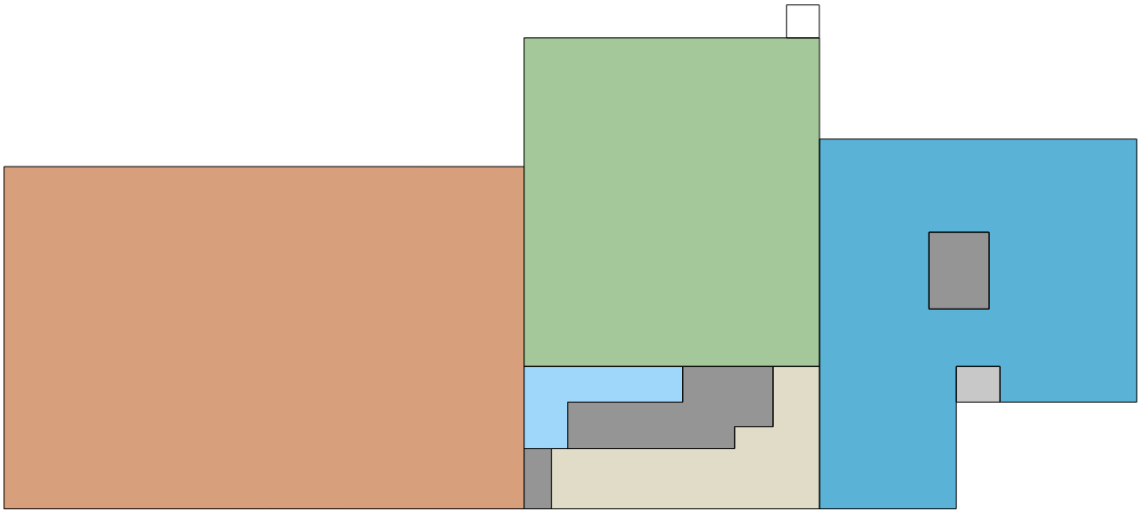
Adjacency Diagrams

Many of the spaces on the shop side need a direct connection to the exterior. These connections are for moving vehicles, materials, and supplies/parts into and out of the space. No major connection is needed between the shop spaces and the administration spaces, but it is convenient to have them adjacent with a minor connection. Supply, supervisor's office, engineer rebuild, and tire areas need direct connection to the shop. The supply area needs a service window for techs from the headquarters shop and area shops to access for parts/supply pick-ups. This area should be easily accessed from the work bays and the exterior with parking nearby. The wash bays and welding area need to be near the work bays but a direct connection for vehicles isn't needed. The connection will be for personnel access and minor supplies. In the administration area a direct connection is primarily needed between the lobby space and training room and the lobby and reception space. Most other connections are secondary. All spaces need access to a restroom.

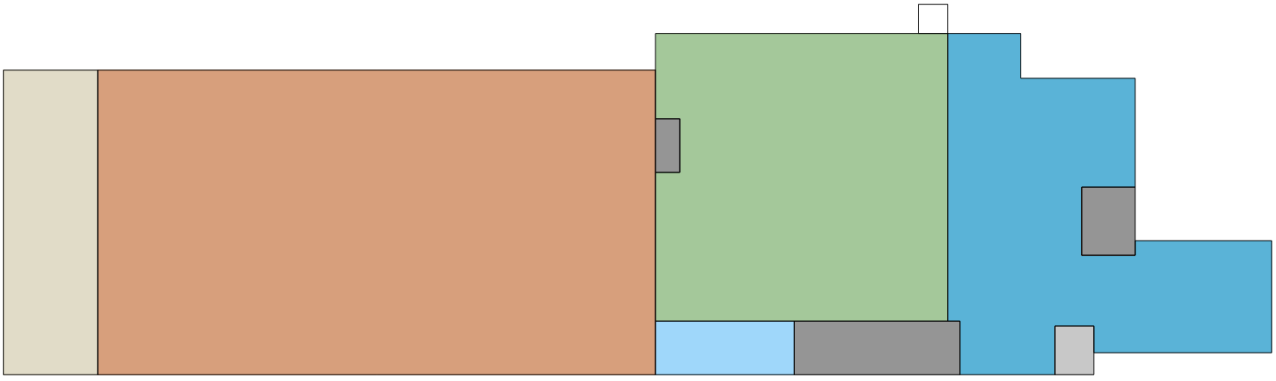


Organizational Concepts

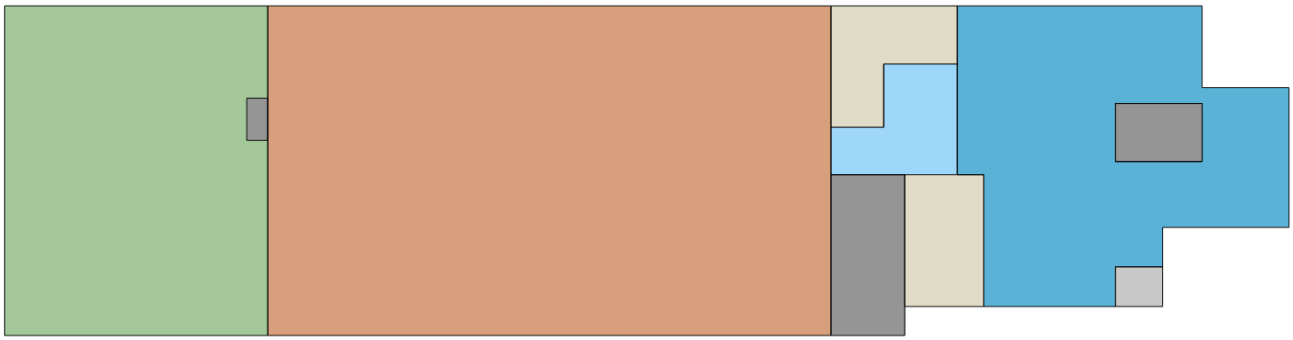
Several options for overall building organization have been developed. These explore the placement and adjacency of the major building components.



Organization 1: This is the current preferred option with the supply area in the middle of the building. This allows for potential future expansion of shop bays. The administration area to the far side gives this prominence as the main entry to the building.



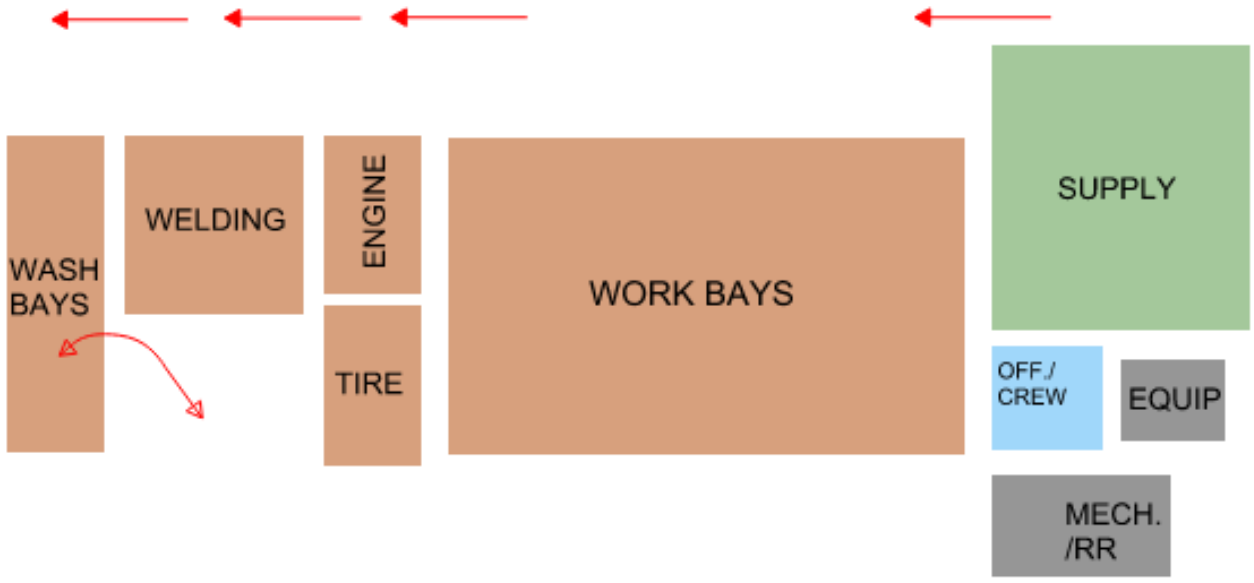
Organization 2: This option places the facilities area on the far end of the building. However, this setup would limit potential future growth and cause facilities staff to walk through the shop activities to access the office, crew room, and restrooms. It is preferred to keep departments consolidated within the building with easy access building support spaces like restrooms.



Organization 3: Placing the supply area on the end allows that space to function mostly independent from the other spaces. However, this would require its own restroom and limit future bay expansions. It would make delivery and pick ups from non-local entities simpler.

Space Layouts

Shop General: The likely best option for the shop layout sequence would be the shop administration areas, shop building support and supply area, then the work bays, then engine rebuild and tire repair, then welding, and finish with the wash bays. The wash bays can either be on the end or across from the welding area. See below for further explanation. This sequence allows the work bays to be closest to the restrooms, crew room, and supply since these will be the most frequently used. The engine rebuild, tire, and wash bays all supplement the main shop services and don't require a direct connection to the other areas. The welding space also requires only minor connection to the other spaces.



Work Bays: One option for a standard single vehicle bay and two options for double super bays. The major differences between these options are the number of doors and overall square footage. The first concept has 20-foot-wide bays with a 16-foot-wide door. This gave all 20 feet of the bay width to a single vehicle's workspace. The super bay ideas were proposed by the users as they had seen something similar at another facility. In this instance we are defining super bay as a vehicle bay that is extra wide with a wide overhead door so two heavy duty vehicles can be worked on side by side. The second concept has 27-foot-wide super bays with 18-foot doors of similar dimensions to those the user group had seen. However, this only gives 13.5 feet per vehicle and with 8 feet to 9 feet wide vehicles there is little room to work around, not including adjusting plow positions. The third concept has 35-foot-wide bays with 25-foot-wide doors. This gives 17.5 feet per vehicle. Overall, the difference between the largest super bay and the standard bays is slightly more than 1500 square feet. Since there is relatively minimal difference in square foot and a larger bay would be more efficient to work in an appropriate for future growth the next factor is the overhead doors. We compared the costs between fewer large doors versus an increased number of smaller doors and the costs were relatively minimal. However, the larger doors are more difficult to maintain and will always be subjected to more issues with wind loads. Therefore, the standard bays would be the best solution for this facility. The planned depth of all bays is 55 feet, which can be reduced by 10 feet to reduce costs. A center aisle of 15 feet is also planned. This allows for personnel circulation and movement of large items between bays and to the welding, tire, and engine rebuild spaces.

Wash Bays: Both drive through and side by side wash bay configurations were explored. The drive-through option would limit future bay expansion and the central aisle of the work bays would dead end. The side-by-side configuration would allow for a wider work area around each vehicle and the central aisle could be continuous to the exterior.

Welding: The welding bay can either be confined to one side of the central aisle or cut into the central aisle. As with the wash bay this will depend on the plans for future growth and functionality of the central aisle.

Administration: The administration layouts were explored with various levels of privacy. From all private offices to all open offices. The all-private offices would be the most expensive since it will require a larger quantity of doors and walls. This will also be the most sterile layout with rows of doors down a long corridor. Ultimately a mix will work best with departments separated into suites. Each suite will have a common area with any open office spaces, minor department storage, and possibly small meeting space then private offices will be organized around the perimeter of the common space. The engineering department will need the plan file storage within easy access but doesn't need to be adjacent. The storage for HR and Accounting also needs to be within easy access but not adjacent. The large conference training should be adjacent to the main entry and with easy access to restrooms. The receptionist should also be adjacent to the main entry and near the workroom/mail room. The break room and work room should all be within easy access of all offices. The small and large conference spaces should be located near the office suites with less connection between storage spaces and the large conference room.

Concept Plans: Initial concept plans were produced to explore the space layouts. Any of the shop layouts can be combined with any administrative layouts since these function separately. A hardened space to act as a storm shelter was considered. While this type of facility is not required to meet ICC500 requirements, a structurally hardened shelter should be provided to protect from storm wind speeds in this area, however it may not have full ICC500 mechanical and plumbing system requirements of ICC 500. A space for approximately 100 people is needed of approximately 700 to 800 square feet.

Architectural Systems

Exterior Envelope

Wall Systems: The shop portion of the building will have a pre-engineered metal building (PEMB) wall system consisting of insulated metal panels and girts with insulation at a minimum. The insulated metal panels are required to meet the continuous insulation and air barrier requirements of the energy code. It would be best if the interior could be covered with a metal liner panel. This protects the insulation from damage and gives a clean finish to the space. A partial height metal liner panel and flat face vinyl liner could be used as a more economical finish. Masonry could be added to this portion of the building, but a more extensive wall system would be needed with metal studs, sheathing, air barrier, cavity insulation, and masonry system would be needed which greatly increases the cost especially for a PEMB. For the administration side of the building a metal stud and masonry cavity wall system will be used. This will be supplemented with brick or exterior CMU. There will likely be canopies that are either metal stud and metal panel or premanufactured. Additional metal panels may be used as feature elements. It is preferable to avoid systems like EIFS as these are a continuous maintenance issue and much less durable than masonry. The walls need a minimum of R13 insulation with R5 continuous insulation.

Doors: For the shop overhead doors should be sectional steel insulated doors. These could have a series of vision lites to allow some daylight in and give visual out. There will be coordination required with potential other overhead systems like mechanical systems, fire suppression, and conduits. Overhead coiling doors are not as energy efficient but do have simpler coordination with other overhead elements. Man doors should be aluminum frame with FRP doors. These are more durable and longer lasting doors than hollow metal doors and frames. The administration side would have full glass aluminum doors at most entries. Any back of house type entries should have FRP doors with a lite. Facilities of this type typically have card readers at highly used entry and exit points.

Windows: If desired the shop could incorporate some translucent panel and aluminum frame systems. This would cut down on potential glare caused by traditional windows. The administration area should have aluminum frame windows and insulated low-e tinted glass. There may be several types of interior windows/glazing systems. The shop area would be hollow metal frames, but office could have transaction windows and/or frameless glazing systems.

Roof: The roof of the shop will be a sloped (no more than 2:12) standing seam metal panel. This will have batt insulation (minimum R30) with a vinyl scrim (Simple Saver System). The vinyl system provides both fall protection and a clean flat plane surface for the shop ceilings. The administration area can be either a low slope parapet or traditional slope system. This could be a metal roof or membrane roof depending on costs. The system will likely have coverboard, insulation, and roof deck on the structural framing system.

Interior

Floors: The shop portion of the building should be sealed concrete floors at a minimum. A trowelled epoxy coating system can be used on the floors but the system must be chosen carefully due to tool and equipment impacts. A grit level will need to be specified and sampled to choose the appropriate slip resistance for wet or oily foot traffic but also be cleanable. A typical epoxy flake resinous coating system can be used in the restroom. Office space and crew rooms could be an epoxy system or a vinyl tile system. The administration space will be a combination of carpet tile and vinyl tile. The entry space may incorporate a higher end finish like porcelain tile. Wall base will primarily be 4 inch rubber base.

Walls: The shop partition walls will be a combination of metal studs and gypsum board and CMU. The gypsum board should be abuse-resistant type up to 4 feet minimum. CMU will be needed in wet spaces like the wash bays and will require a waterproof coating. The administration portion of the building will primarily be metal stud and gypsum board. All walls will go to deck to minimum sound disruption between spaces. Restroom walls could have a wainscot of tile or epoxy resinous. Some walls will incorporate stone from the Docking building as feature walls.

Ceilings: Ceilings in the shop area will be exposed to structure with the vinyl scrim system. Office, crew rooms, and restrooms should have suspended acoustic ceilings to limit heating and cooling of excess volume. The administration area will have a combination of suspended acoustic panel ceilings and gypsum board ceilings. Style of acoustic panels may vary with conference and visitor spaces have a more decorative tile than standard offices.

Other: Window coverings should be roller shades. Shade fabric options should be determined during design to meet the needs of the spaces. Casework will be plastic laminate and primarily confined to the administration area. Toilet accessories will match the owner's supplies.

Structural Systems

The most efficient and economical structural system for the shop will be a pre-engineered metal building. This will have a super structure for the column and beams. There will be at least one intermediate column line. The intermediate line will make the overall structure more economical and provide a place to anchor utilities. The repetition of the work bays, need for function over aesthetics, and linear layout make PEMB the best option. A consistent height gabled roofline is the most economical option. The administration portion will likely be better as a conventional structural steel since there be little repetition of space and the overall shape is potentially more square than linear. Pending the findings of the geotechnical report the shop floor will be a minimum of 8-inch-thick concrete and the office likely 4-inch concrete. The office storage spaces may have a thicker floor slab due to the density and weight of the storage. The foundation type, depth, and size will be dictated by the report.

Mechanical, Electrical, and Plumbing Systems

A. Plumbing

1. General: Plumbing will be installed in accordance with the following listed codes and manuals:

a. International Plumbing Code, 2018
b. International Fuel Gas Code, 2018
c. International Energy Conservation Code, 2018
d. Americans with Disabilities Act (ADAAG)

2. Piping systems

a. Domestic water

1. Piping: Domestic hot water, hot water re-circulating and cold-water piping will be copper.
2. Insulation: Domestic water lines will be wrapped with fiberglass insulation and an all-service jacket to prevent condensation and energy loss.
3. Valves: Shut off valves will be provided on all branch lines to individual plumbing fixtures or groups of fixtures from the main.

4. Water hammer arrestors shall be used to protect water lines against water hammer.
5. Water entrance will be provided with water meter and reduced pressure backflow preventer located in the mechanical room.

b. Waste and Vent

1. Piping: Above grade, waste and vent piping will be hubless cast iron pipe with hubless connectors and fittings. Below grade, waste and vent piping shall be cast iron pipe with compression joints or schedule 40 PVC. Interior clean-outs will be provided as required by code and design guides. Exterior clean-outs will be provided at each line exiting the building. Minimum underground pipe size shall be 2 inches.
2. Insulation: Waste and vent piping will not be insulated.

Plumbing systems for the administrative and support areas of the building will be typical commercial fixtures. The work bays will have trench drains with the best placement being towards the doors. This helps to keep the center aisle free of slippery surfaces. Water for the shop will be delivered with overhead reels. All shop spaces will need to connect to a sand oil separator which will need easy access for cleanout. The wash bays will need a Hotsy machine and trench drains. The bay for the paint truck will need a sieve to catch the paint chips.

c. Gas

1. *Natural gas piping shall be supplied at low pressure to all gas fired equipment in the building.*
2. Piping: Above grade gas piping shall be ASTM A53 seamless carbon steel pipe with class 150 threshold malleable iron fittings or standard welded fittings. Below grade pipe shall be HDPE pipe with fusion welded fittings.
3. Gas piping will not be insulated

d. Compressed Air

1. Piping: compressed air piping will be copper or aluminum. Location of compressed air will be coordinated with the owner for later design submittals.
2. Insulation: Compressed air piping will not be insulated.
3. ½" and 3/8" hose reels will be provided for the work bays.

e. Vacuum System

1. Vacuum system will be coordinated with the Owner for later design submittals where required.

f. Overhead Oil/Coolant/Grease System

1. An overhead piping system and hose reels will be provided for the overhead oil system. Piping will vary between schedule 160 to schedule 40 to handle different pressure required for each lube system.

3. Equipment

a. Water Heater: High efficiency condensing gas fired water heater shall be provided for the domestic hot water system. Hot water circulating pumps will be provided to reduce the wait and waste of water at the plumbing fixtures.
b. Water softener: A water softener will be considered for domestic water.
c. Floor drains, floor sinks and clean outs: Cast iron floor drains, floor sinks and cleanouts will be provided as required. These items will be provided with brass grates or cover plates as appropriate.
d. Emergency shower or eye wash: Emergency shower or eye wash stations with audible alarm will be provided in rooms where they are identified as required.
e. Wall hydrants: Freeze proof wall hydrants will be located around the exterior of the building for general purpose use. Hose bibs will be provided in the interior mechanical rooms.
f. Roof Drains: Regular and overflow cast iron roof drains with cast iron dome strainer will be provided.
g. Sand/Oil Separator: Sand oil separator will be provided for the maintenance shop area to separate the oil and the sand prior to discharging to the city main sewer system.
h. Existing Hotsy machine will be relocated to the new wash bay area. Remote start switch will be provided.

4. Plumbing Fixtures

a. Lavatories, Water Closets and Urinals will be wall hung vitreous china and provided with carriers and fittings for heavy duty use. Water closets and urinals will be provided with infra-red sensor operated flushometer valves. Lavatory's faucets will be provided with infra-red sensors.
b. Sinks will generally be stainless steel, one or two compartment as required.
c. Water coolers will be electric wall mounted.
d. Janitor basins will be molded stone, floor type.
e. Showers will be provided with low flow heads for water conservation at 1.25GPM.

B. HVAC

1. General: **HVAC systems will be designed and installed according to the following listed publication:**

a. ASHRAE 90.1-20 Energy Standard for Buildings except Low-Rise Residential Buildings
b. ASHRAE 62.1-2022 Ventilation for Acceptable Indoor Air Quality.
c. NFPA 90A Installation of Air Conditioning, Ventilation, and Heating Systems.
d. IBC 2018 International Building Code
e. IECC 2018 International Energy Conservation Code
f. SMACNA HVAC Duct Construction Standards

2. Air Distribution Equipment

a. Work Bays:
1. Option 1 will be infra-red radiant heaters suspended from the structure.
2. Option 2 will be radiant slab system with infra-red heaters as supplement.
3. Option 3 will be roof top unit with heating and cooling.

b. Supply Room:
1. Roof top unit with cooling and gas heating.

c. Shop Support Area:
1. Roof top unit with cooling and heating.

d. Facilities:
1. Heating only with suspended infra-red heaters or gas heaters. Radiant slab can be an option as well.

e. Administration Area:
1. Packaged DX variable air volume (VAV) roof top unit.
2. Single duct VAV boxes with reheat coils are provided for each desired comfort zone.
3. (2) sealed combustion condensing boilers with 10:1 modulation. Hot water temperature reset based on OAT 110-160 degree Fahrenheit.
4. Variable speed pumping based on system differential pressure for pumping energy savings.

f. JCI Metasys or equivalent for systems control, optimization, C02 monitoring and control, logging, trending, occupied/unoccupied setpoints, remote operation, alarms, etc.

g. Welding shop will be designed per the Industrial Ventilation handbook. Make up air will be delivered behind the welder and exhausted through the exhaust hood. Welding shop will be heating only.

C. Electrical

1. **Power:** Electrical power systems will be installed in accordance with the following listed codes and manuals:

a. NFPA 70 – National Electrical Code 2017
b. Americans with Disabilities Act (ADAAG).
c. NFPA 101 Life Safety Code.
d. NFPA 90A Installation of Air Conditioning, Ventilation, and Heating Systems.

a. Interior System

i. The switchboard and service entrance will be created in the room designated for such electrical equipment or in a mechanical room with enough space for such electrical equipment. The main distribution panel will be service entrance rated. Surge protection will be provided in the MDP. Power Logic Panel SQUARE D PM 5000 series will be provided and will be connected to the building BMS system

ii. The electrical service will be 277/480 volt, 3 phase, 4 wire, wye. Step down transformers will be provided for 120/208 V and 120/240 V system as required for the work bay area.

iii. Surge protection will be provided to protect panelboards dedicated to serving computer receptacles and all computer equipment.

iv. Electrical wiring systems will consist of copper conductors in steel conduit. PVC conduit will be used below grade.

v. All wiring devices will be 20-amp, specification grade. Ground fault and isolated ground type will be provided as required.

vi. The system will be grounded per NEC.

vii. Receptacles will be provided as required for each space based on equipment room layout/ furniture layout, and any other requirements.

b. Exterior

i. General Use.

1) Convenience receptacles will be provided near mechanical equipment.

2) Receptacles will be located near entrance doors and other locations where required by the owner. Exterior receptacles will be weather proof and ground fault interrupted.

c. Building Emergency Power System

i. Back up power generator will be provided for the building. The generator will be sized in coordination with the owner as to support the whole facility or just part load.

f. **Lighting**

a. Interior

1)

1) Lighting in finished spaces will consist primarily of 1x4, 2x4 and 2x2 recessed LED type fixtures.

2) Lighting in small and unfinished areas will use pendant or surface mount LED type fixtures.

3) Exit signs will be LED type for long life and low maintenance.

4) Dimming and occupancy sensors will be provided for lighting controls in public restrooms, hallways, offices, and classrooms.

5) High bay type LED will be provided for the work bay area.

D. Site Utilities

1. Electrical

a. 12,470V, 3 phase overhead service is available near the property and is owned by Evergy. Evergy will extend the power to the site as required and provide underground feeders to a pad mounted transformer near the main electrical room. Primary conduits will be provided by the electrical contractor.

2. Natural Gas

a. Natural gas will be extended to the site as required.

3. Communication

a. Three 4-inch conduits will be provided from the main telecom room to the nearest street or easement for use by the appropriate company to provide service to the building.

4. Lighting

a. Lighting will be provided at entrances to the site and building, sidewalks, and parking lots. Exterior fixtures will be LED. Lighting will be controlled through a time clock, contractor/photocell. Minimum intensity level of 0.5 FC shall be provided over the entire site.

5. Water, Sanitary Sewer and Storm Water

b. Water, sanitary sewer and storm will be extended to the building by the Civil Engineer.

E. Special Systems

1. Fire Alarm

a. An addressable alarm and notification system will be provided.

b. Detectors, pull stations, horns, speakers, strobes, etc. will be provided throughout for complete coverage.

2. Fire Protection

a. Technical Criteria and Standards

NFPA 13, Standard for the Installation of Sprinkler System
NFPA 24, Standard for the Installation of Private Fire Service Main and Their Appurtenances.
NFPA 70, National Electric Code
NFPA 72, National Fire Alarm Code
NFPA 101, Life Safety Code

i. General

The following will be included as part of the work during design:

1) Available static and residual pressures.
2) Backflow preventer will be provided on building to protect the domestic water system.

3) Flow testing of the fire water system
4) Design requirements

ii. Mechanical/Electrical Rooms: Ordinary Hazard Group 1, 0.15 GPM/SF over the most remote 3000SF area.

iii. Offices/Multipurpose Room: Light Hazard, 0.1 GPM/SF over the most remote 1500SF area.

iv. Fire Protection System

1) The building will be fully sprinkled with a hydraulically designed sprinkler system.

2) Underground piping will be provided in accordance with NFPA 24 Material will be ductile iron and will be sized for maximum flow velocity not to exceed 10 feet per seconds.

3) Interior piping for the fire sprinkler system shall be schedule 40 pipe seamless steel pipe for fire protection use. Threaded, flanged or grooved fittings will be provided as required.

4) Fire department connection will be provided for the building and final location will be coordinated with the Authority Having Jurisdiction and the fire department.

5) All exposed piping will be labeled in accordance with the ARNG Design Guides.

3. Access Control.

2) Access control will be coordinated with the owner and card keys will be provided at the doors as required. Doors that do not require card access will be keyed lock or combination lock. All components will be provided by the contractor.

4. Telecommunication/Local Area Network

a. Telecommunications and LAN outlets will be provided in the entire facility.
b. The systems shall be Category 6A solution and include outlets, devices, cable, conduit, distribution board and all other equipment required for complete and functional systems.
c. Each work station will be provided with a phone/data outlet. (3) category 6A cables will be provided to each workstation; one for phone and two for data. Private offices will have two outlet locations generally on opposite sides of the room unless otherwise dictated by room geometry.
d. Three Category 6A cables will be provided from each outlet to the demark location. Each individual Category 6A cable will be connected to a jack at the outlet and run to a patch panel in the data demark locations.

e. Additional data and phone lines will be provided at locations identified by the users as having such requirements.
f. The design and cost estimate are based on a Category 6A cable system. Category 6A is available and will support 10 Gigabit applications.
g. The telephone/ data systems will be designed as a system with all equipment, connections, testing, etc. completed by the contractor. A record of the test results will be provided to the owner upon completion in both a paper and electronic format. A 15 year product warranty will be required on the cabling system.
h. Phone system and all of the network electronics shall be provided and installed by the owner. Cross-connects and patching shall be provided by the owner.
i. KDOT/OITS will be providing ethernet cabling, router and switch in a patch panel to WAN connection. Contractor will provide rough-ins, conduits, and cable trays.

3. Closed Circuit Television

a. CCTV will be provided as directed by the owner.

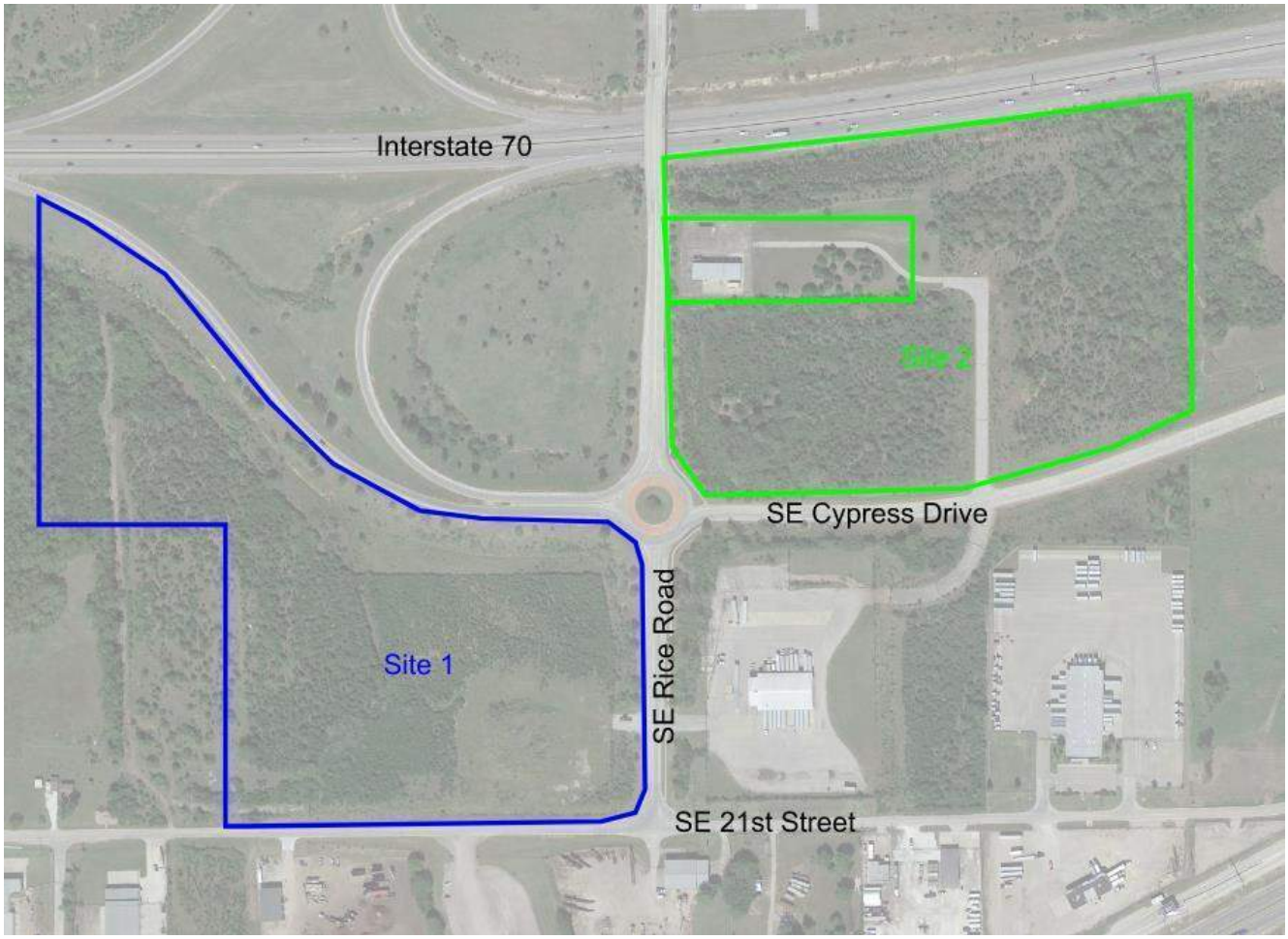
6. Public Address System

a. A total coverage paging system originating at the owner provided phone equipment will be provided throughout.

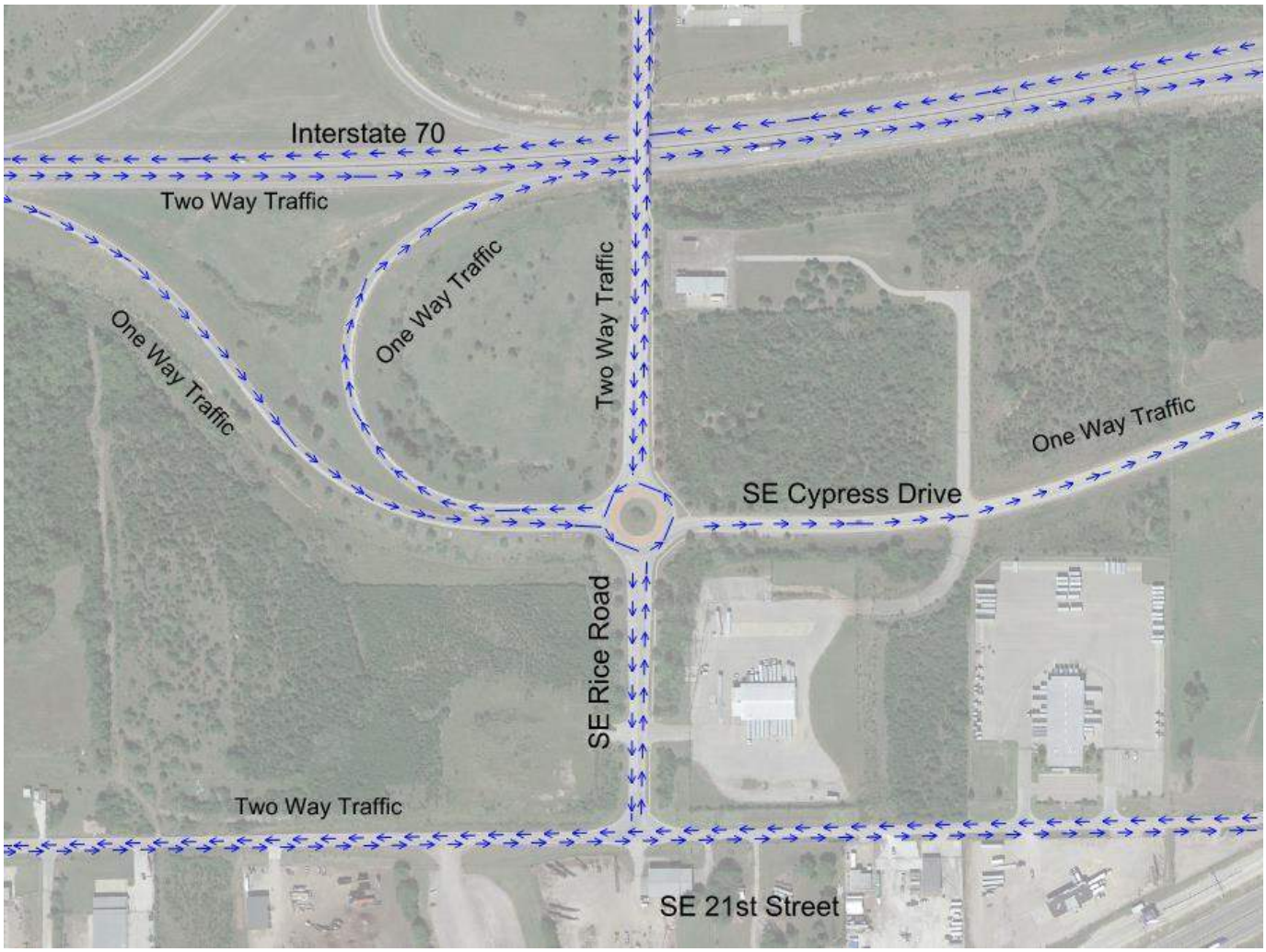
b. Volume control will be provided on speakers in all areas.

Site:

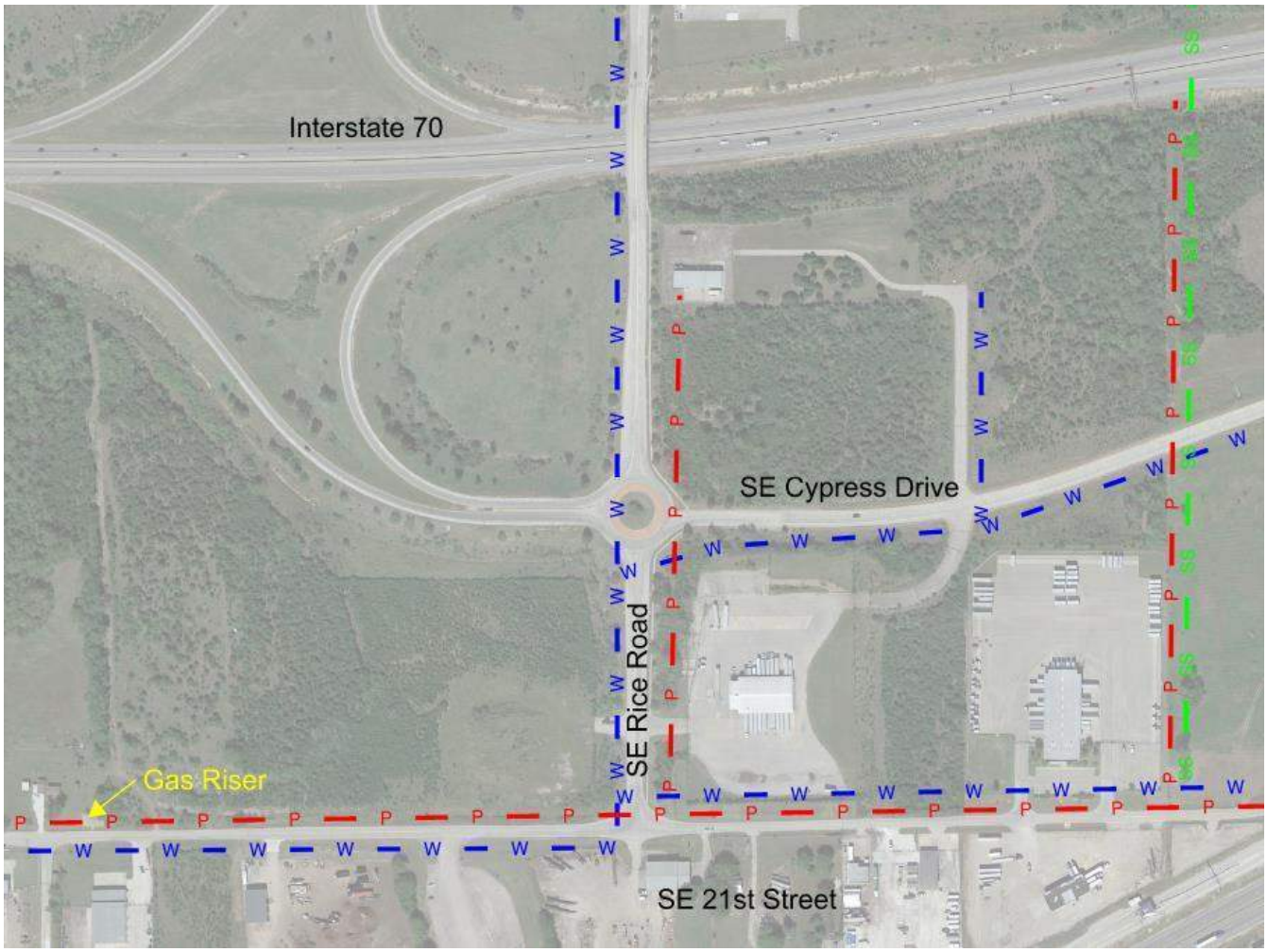
Site Criteria



Boundaries and Location: The above diagram shows the locations of the two potential sites. Both sites are approximately 22 acres, and each will be platted and zoned as part of the project. Site 1 consists of right of way and a purchased parcel. Site 2 is all right of way.



Traffic and Site Access: The traffic diagram shows the road directions for each surrounding street. Site 1 is able to access both SE Rice Road and SE 21st Street and has two-way traffic. Site 2 can only access SE Cypress Drive with one way traffic approaching from the west which will make the site more difficult to utilize.



Utilities: Known utilities include water and electricity. There is also likely gas nearby since there is a gas riser to the west of Site 1. The water line is an 18" line which should be more than sufficient for the facility's needs. Water pressure tests will need to be conducted to confirm. Sanitary sewer will need to be connected to the west for Site 1. Site 2 could connect to a sanitary sewer to the east but there is not enough fall for an east connection with Site 1. Each site will need to manage stormwater within the site per the City of Topeka's requirements.

Topography: There are significant grade changes on each site. Site 1 has an elevation change of approximately 20' from south to north. The grade is steeper along the previous interstate exit and towards the north portion of the site. It is flatter along the southeast portion of the site. Site 2 has a high point along the access road that bisects the site with a 10' elevation change to the west and a 20' elevation change to the east. This means Site 2 has steep grades overall. Ideally the shop and administration facility would work best as a single level facility so either site would need some significant earthwork changes. This may be balanced on site with stormwater management.

Site 1 Pros:

- The site acreage and layout is appropriate for the program elements.
- The site can be accessed from both SE Rice Road and SE 21st Street and both roads have two-way traffic. This would allow for multiple site access points and better on-site traffic flow and separation.
- Water, power, and gas are located very near or on the existing site.

Site 1 Cons:

- Sanitary sewer will be a longer run than Site 2 and will have more complexity due to the number of neighboring properties that will eventually need to tie in

- The site does have major grade changes in not enough flat area to place the building without significant earthwork.

Site 2 Pros

- Shorter and less complex sanitary sewer runs. There are relatively fewer neighboring properties that would eventually be required to tie into the sewer line.
- Water, power, and gas are located very near or on the existing site. Gas maybe a further distance than Site 1.

Site 2 Cons:

- The site has enough acreage for the program, however the access road that bisects the site limits and condenses the program elements. This may mean limited future growth and more difficult heavy duty vehicle traffic.
- SE Cypress Road is one way traffic and is the only road from which the site can be accessed.
- The grades are steeper than Site 1

Concept Site Plans

Multiple site plans were developed to compare both sites and the organization of site elements. The site elements included site access, on-site traffic flow and separation (delivery traffic, maintenance vehicle traffic, fuel traffic, and personal vehicle parking traffic), building placement including the future lab, fuel island, auction storage, repair vehicle parking, personal vehicle parking, loading dock, and fencing and gates. This ultimately led to the selection of Site 1 Option 1 as the most feasible scenario. The below information will be in relation to Site 1. Additional concept site plans can be referenced in Appendix H.

Site Access: The existing entry drive off Rice Road will be utilized. Due to the Rice Road median and the distance to the intersection another access off Rice Road will not be possible. If possible, widening the existing drive would improve site circulation, especially for heavy duty vehicles and semi-trucks. New access drives will need to be added off SE 21st Street. These will likely be required to align the drives on the south side of the street. Two drives would be ideal to keep different vehicle traffic separated.

On-Site Traffic Flow: The diagrams incorporated traffic flow patterns for heavy duty maintenance vehicles, delivery vehicles, personal vehicles, and fueling vehicles. The maintenance vehicles will need access to the work bays and the repair parking as well as a fueling area. These vehicles need a large amount of paving for maneuvering around the site. The delivery vehicles will be semi-trucks and will need access to the loading dock. These need a lot of space and easy turning movements. Personal vehicles mostly need access to the main parking lot, but some will need access to parking within the fenced yard for overnight storage. Ideally these vehicles would not mix with the maintenance vehicles nor the delivery vehicles, but inevitably that will have to some extent at the entry access points. Fueling vehicles are light duty vehicles that are only coming to the site for fueling and should interact as little as possible with other on-site traffic. These should enter and leave from a single access point.

Building Placement: The concepts explored several locations for building placement. Important factors include visibility from the streets, topography, location of parking, area for future lab, and access for maintenance and delivery vehicles. The placement for Option 1 was chosen as this is the flattest part of the site with good visibility of the facility to the road, room for the lab and heavy-duty vehicle traffic.

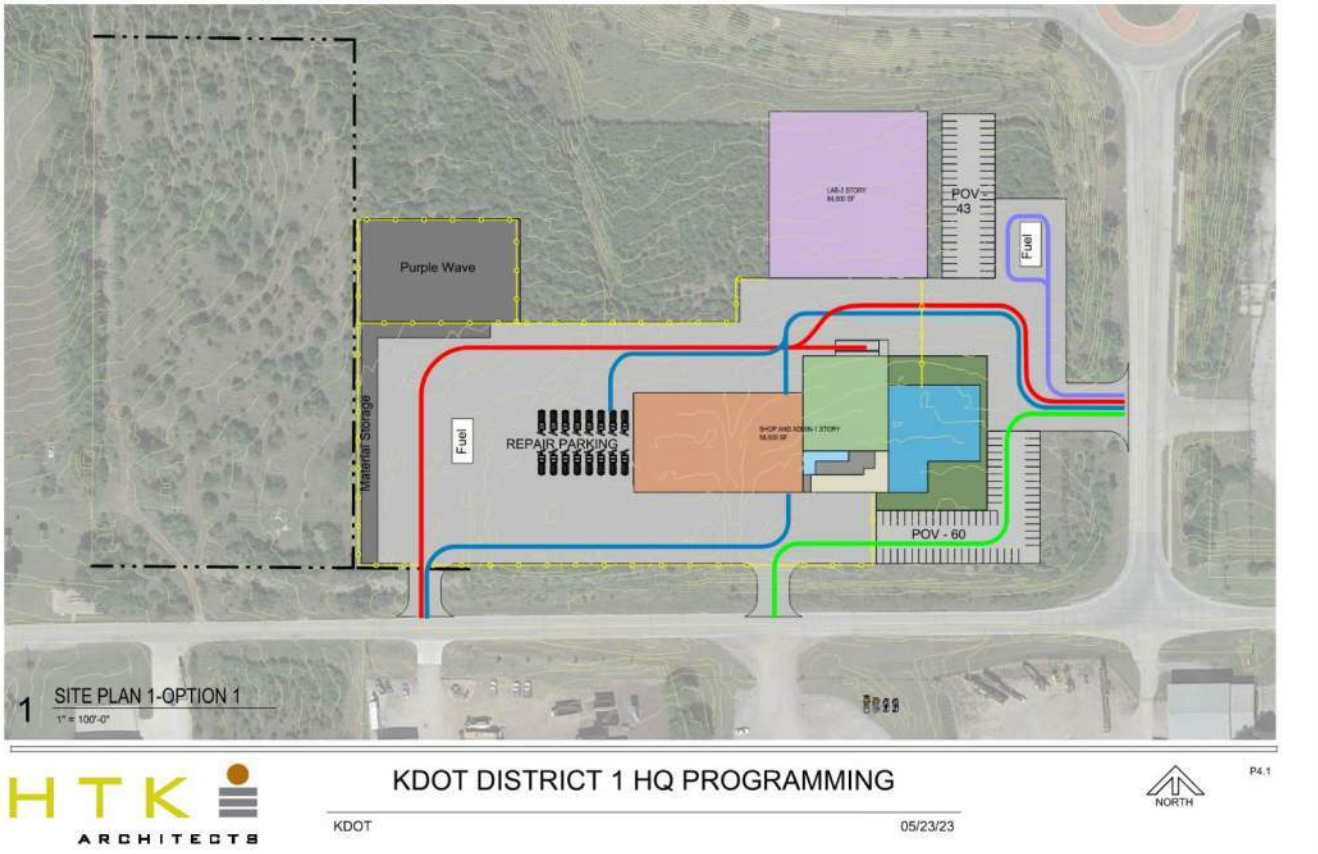
Fuel Island: The fuel island for off-site vehicles needs to be placed in an easily accessible location close to one of the entry points. This will keep those vehicles from disrupting other site traffic or site activities. This area would ideally be outside of the fenced gate. The maintenance vehicles will also need fuel on-site and this needs to be in a location where heavy-duty vehicles can make wide turns.

Auction Storage: The auction storage needs to be 1.5 times larger than it currently is and should be located away from most other site activities but still accessible for buyers. This area should be fenced separately from the rest of the site.

Repair Vehicle Parking: This area is for approximately 20 heavy duty maintenance vehicles in queue for repair or prep. This area should be within the fenced yard and near the shop work bays.

Personal Vehicle Parking: Personal vehicle parking should be near the main entry of the administration portion of the building. This area will have the most staff members and visitors using the training room. This should be located near two site entry points to simplify traffic patterns and prevent dead end parking lots. It should be separate from the maintenance yard and delivery traffic.

Fencing and Gates: Much of the site will need to be fenced for security. Ideally most entry points will have a gate. Gates will be open during the day. Nighttime deliveries will require access through the gates. Fencing on the less visible side of the site can be chain link with razor wire on top. Fencing on the visible roadside will be a more decorative product that is still secure from trespassers.



Cost Estimate:

The cost estimate is attached and has a focus on price per square foot for the building components and unit prices for the various site components.

Cost Estimate:

The cost estimate is attached and has a focus on price per square foot for the building components and unit prices for the various site components.

Appendix A

Updated District 1 Facility needs from 1-5-2023

Proposed Facility

This project would relocate and consolidate to a single site the following facilities:

a) District One Supply and Stockroom (1-0010)
b) District One Headquarters Office and Maintenance Shop (1-0001)

The proposed Maintenance shop would be approximately 32,000 sq ft?? and include:

32,000 x

- 7 double depth Equipment repair bays (total of 14 single bays for mechanics)
- 1 double depth Wash Bay / Paint Truck Storage Bay (or 1 bay for each of the listed functions) Paint truck storage bay will need a pressure washer and drain to clean the striper
- Welding shop approximately 40' x 60' required (minimum of two bays). Shop supervisor said they would like 50 x 60. He said the space they have is tight now and they would like a wide door to make it easier to deliver long iron in on a forklift.
- 4 vehicle bays (conventional garage space for surveyor truck, facilities truck, 2-IT vehicles)
- Equipment supply storage approximate size to be determined (For Mowers and other outdoor equipment) If this is for Facilities, it is for mowers/plumbing supplies/electrical supplies and could be connected to the space for the facilities pickup storage. Approximately 20 x 20
- Purple Wave Storage approximately 30' x 40' required (could be stand-alone building)
- Shop Employee Crew Space Approx 16' x 20' (8 lockers)
- Facilities Employee Crew Space Approx 12' x 12' (3 lockers)
- Rest room Fixtures will be established by code
- Facilities Supervisor office Approx. 130 SQFT
- Shop superintendent office Approx 130 SQFT
- Shop Superintendent office Approx. 130 SQFT
- Administrative Staff – clerical, file room Approx 130 SQFT
- Mechanical Room
- IT / Server Room
- NAPA Stockroom Approx. 11,000 SQFT
- NAPA Open Office space Approx 1,000 SQFT to include One Office
- Loading dock

Other Shop needs include:

- Fuel Island
- Shop Crane
- Air Compressor
- 4 Post Vehicle Shop lift We have a 4 post and 2 post car lift that we will take with us as well as a portable truck lift
- Locker Space
- No vehicle exhaust; will continue to use portable vehicle exhaust units.
- No lube system
- Area for tire changing for light fleet vehicles, tire storage will be elsewhere.
- Will include eye wash-emergency shower as required by code.

- Storm shelter? yes

The proposed Administration building would be approximately 14,000 sq ft?? and include:

14,000 x

- Office space for 25 district staff Approx 130 SQFT EACH
- Conference room approximately 50’ x 50’ (the current conference room is 45’ x 50’)
- Conference room Approximately 14’ x 20’
- Employee break room Size to be determined (for 25 people), (what appliances are needed)
- Rest room Fixtures will be established by code
- Plan File storage room Approx 30’ x 60’
- Accounting / HR storage space Approximately 20’ x 30’
- IT Storage / Workroom Approximately 20’ x 20’
- Mechanical Room
- IT / Server Room
- Janitor’s closet

Other Administrative Building needs include:

- Greeting area for visitors (Lobby/Waiting Room)
- Robert would like a monumental entrance
- Work Room, including printer, recycling, office supplies
- Storm shelter? We will need to have somewhere for employees to shelter

Barbara’s comments

Do you need coffee bar or counter/cabinets in the conference room? We have a small kitchen in the conference room now. It would be nice to have a work space and sink to maintain the coffee maker.

In administration, does anyone have personal printer? No we currently have on upstairs and one downstairs

Coat closet?

Ice machine in Shop? We have a water/ice machine in the admin building now that the mechanics use. It would be nice to have one in the shop since they will be a separate building.


KANSAS
DEPT. OF TRANS.
DISTRICT 1

Appendix B

	A	B	C	D	E	F
1		**KDOT Equipment List**				
2		**Equipment**	**Voltage**	**Phase**	**Amp**	**Size**
3		Welding/Machine Shop				
4		Big parts washer	208/240	3ph		
5		CNC Brake	208	3ph		
6		CNC Shear	208	3ph	65 amp	
7		Welder Plugs	220	1p	50 amp	
8		Big Drill press				
9		Small Drill Press	220	1ph	30amp	110
10		Bandsaw	208	3ph	22amp	
11		Big bench grinder by saw	220/440	3ph	20amp	
12		Big Stick Welder				
13		Pirohna-shear?	240/480	3ph	50amp	
14		Rod Heater 1	240/480			
15		Rod Heater 2	240/480			
16		Tig Welder	220	1ph		
17		Press	230/460	3ph	7amp	
18		Pipe Bender				
19		Tubing Roller	would like to get			
20		Roller-metal		3ph	10amp	
21		Lathe	240	3ph	30amp	
22		Mill	110/220		11amp	
23		Surfacer-manifold big	220	1ph	60HZ	
24		Surfacer- manifold small	110			
25		Small Parts Washer 1	110			
26		Small Parts Washer 2	110			
27		Wolf Drill Lab- 0900196	380	3ph	10amp	**50 HZ
28		Kalamazo Chop Saw- Large 052426	250		20	
29		Bridge Port	208	3ph	12.5	**50/60 HZ
30		Supermax YCM-244 0900296	208	3ph	30amp	
31		Nardini- SZ20807 0900691	220	3ph	36amp	
32		Drill Big Sharpener 053760	110			
33		Vertical Sander Belt	230	3ph	20amp	
34		LD Work Bay				
35		Two Post Lift	230	1ph	19amp	
36		Four Post Lift	208/230	1ph	20amp	
37		Tire Area				
38		Tire Machine	110			
39		Tire Balancer- Small	220	1ph	30amp	
40		Tire Balancer- Big	110			

Appendix C

State of Kansas - List of Applicable Codes for construction projects on State property

Department of Administration; OFPM-DCC

The code editions must be listed on the code footprint and must be listed on the title page of each discipline's construction documents.

A. International Building Code (IBC), 2018 Edition.
   a. Chapter 11, Accessibility, is deleted. See Item N below.
   b. Additionally, The Life Safety Code (NFPA 101) will also be applicable for occupancies described in Item J. and K. below.

B. International Building Fire Code (IFC), 2018 Edition.
C. International Residential Code (IRC), 2018 Edition.
D. International Existing Building Code (IEBC), 2018 Edition
E. International Mechanical Code (IMC), 2018 Edition.
F. International Plumbing Code (IPC), 2018 Edition.
G. International Fuel Gas Code (IFGC), 2018 Edition.
H. International Energy Conservation Code (IECC), 2018 Edition or ASHRAE 90.1-2013.

I. The codes and standards referenced in the Referenced Standards Chapters in the IBC, IFC, IRC, IMC, IPC, IFGC and IECC shall be applicable. Codes listed in item J below shall be identified on the code footprint, if applicable to the project. The NFPA editions noted in Item K below shall be applicable for the occupancies listed and shall be identified on the code footprint if applicable to the project.

J. National Fire Protection Association (NFPA), National Fire Codes and Standards for non-Healthcare occupancies described in Item K.
   a. NFPA 10 – 2018 Edition – Portable Fire Extinguishers
   b. NFPA 13, 13D and 13R – 2016 Edition – Installation of Sprinkler Systems
   c. NFPA 14 – 2016 Edition – Installation of Standpipe and Hose Systems
   d. NFPA 20 - 2016 Edition – Installation of Stationary Pumps for Fire Protection
   e. NFPA 25 – 2017 Edition – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
   f. NFPA 45 - 2015 Edition - Fire protection for Laboratories Using Chemicals
   g. NFPA 70 – 2017 Edition – National Electric Code (NEC)
   h. NFPA 72 – 2016 Edition – National Fire Alarm Code
   i. NFPA 96 – 2017 Edition – Ventilation Control and Fire Protection for Commercial Cooking Operations
   j. NFPA 101 – 2018 Edition – Life Safety Code–only applicable to adult & boarding care homes per OSFM K.A.R.–22-11-8.
   k. NFPA 110 – 2016 Edition – Emergency and Standby Power Systems
   l. NFPA 241 – 2013 Edition – Safeguarding Construction, Alteration and Demolition Operations

K. National Fire Protection Association (NFPA), National Fire Codes and Standards applicable only for Healthcare Occupancies (i.e. hospitals, nursing homes, immediate care facilities) that receive Center for Medicaid/ Medicare Services (CMS) funding and inspections.
   a. NFPA 10 – 2010 Edition – Portable Fire Extinguishers
   b. NFPA 13, 13D and 13R – 2010 Edition - Installation of Sprinkler Systems
   c. NFPA 25 – 2011 Edition – Testing Fire Sprinkler Systems
   d. NFPA 70 – 2011 Edition – National Electric Code (NEC)
   e. NFPA 72 – 2010 Edition – National Fire Alarm Code
   f. NFPA 99 – 2012 Edition – Health Care Facilities Code
   g. NFPA 101 – 2012 Edition – Life Safety Code
   h. NFPA 110 – 2010 Edition – Emergency and Standby Power Systems

L. ASME A17.1/CSA B44-2016 – Safety Code for Elevators and Escalators

M. Kansas Fire Prevention Code (This code combines many different documents including Kansas Statutes Annotated (K.S.A.) and Kansas Administrative Regulations (K.A.R.).) A list of pertinent statutes and regulations can be found at the Office of the State Fire Marshal (OSFM) website at www.firemarshal.ks.gov.

N. K.S.A. 58-1301 et seq – 2010 ADA Standards for Accessible Design (2010 ADA Standards).

O. Kansas State Boiler Code (K.S.A. 44-913 et seq) available through the Office of the State Fire Marshal (OSFM) at www.firemarshal.ks.gov.

HTK ARCHITECTS

KDOT District 1 Headquarters Shop and Administration Program

Working Draft
6/13/2023

Program Summary

	Function	Existing NET SF	QTY	Proposed Est Dims		Proposed NET SF	QTY	Systems	Comments
1.0	**WORK BAY / SHOP / SUPPLY**								
1.1	**SHOP**					**28,025**			
1.1.1	Work Bays-HD *Option*	9,502		20	55	1,100	12		20x55 bay size (1 vehicle), bridge crane
1.1.2	Work Bays-Super *Option*			35	55	1,925	6		35x55 bay size (2 vehicles), bridge crane
1.1.3	Work Bays-LD			20	55	2,200	2		1 bay w/ 2 post lift, 1 bay with 4 post lift
1.1.4	Tire Area	1,160		27	55	1,485	1		
1.1.5	Bolts	125							In new engine rebuild and tool storage
1.1.6	Engine Rebuild and Tool Storage	0		27	55	1,485	1		
1.1.7	Welding Shop	2,508		58	70	4,060	1		jib crane
1.1.8	Wash Bay	496		27	55	1,485	1		
1.1.9	Wash Bay-paint	0		27	55	1,485	1		Cleanup for paint striper
1.1.10	Shop circulation			15	175	2,625	1		
1.2	**SHOP SUPPORT**					**1,390**			
1.2.1	Shop Superintendent Office	125				130			
1.2.2	Shop Superintendent Office					130			
1.2.3	Shop Administration					130			
1.2.4	Shop Crew Room	195				1,000			8 lockers, changing rooms, Paint staff in winter (7-8)
1.3	**FACILITIES**					**2,220**			
1.3.1	Facilities Supervisor Office					130			
1.3.2	Facilities Crew Room					250			3 lockers
1.3.3	Facilities Equipment Storage	1,020				400			
1.3.4	Facilities Vehicle Storage			48	30	1,440			4 reg duty truck parking bays
1.4	**AUCTION - PURPLE WAVE**					**1,200**			
1.4.1	Purple Wave Storage					1,200			Storage for small items to auction
1.5	**SUPPLY - NAPA**					**12,500**			
1.5.1	Supply room	6,146				11,000			shelving and racking
1.5.2	Admin	345				1,000			6 offices in open area, adjacent to supply
1.5.3	Service Window	250				100			part of admin accessible to shop and walkup
1.5.4	Dock					400			outside delivery + area pickup

HTK ARCHITECTS

1.6	**SHOP BUILDING SUPPORT**					**1,700**			
1.6.1	Restrooms					300	2		M / F 3 stall dedicated to shop and supply areas, near break room, 1 shower each
1.6.2	Mechanical					950			
1.6.3	Electrical								
1.6.4	POL/Compressor					150			
1.6.5	Data					150			tank monitoring-accounting and shop superviser
1.6.6	Custodian					150			
1.6.7	Generator						1		shop, fuel, data

1.7	**EXTERIOR COMPONENTS-SHOP**								
1.7.1	Equipment Parking						20		
1.7.2	Purple Wave Storage	21,000				70,000			
1.7.3	Fuel Island								gas and diesel-
1.7.4	POV Parking	72					80		
1.7.5	Light Duty Parking-in fence						8		eight to ten
1.7.6	Equipment Testing Area					10,000	1		Away from building-cleared area

WORK BAY / SHOP / SUPPLY								
SUBTOTAL					47,035			
Gross factor	10%				4,704			
TOTAL					**51,739**			

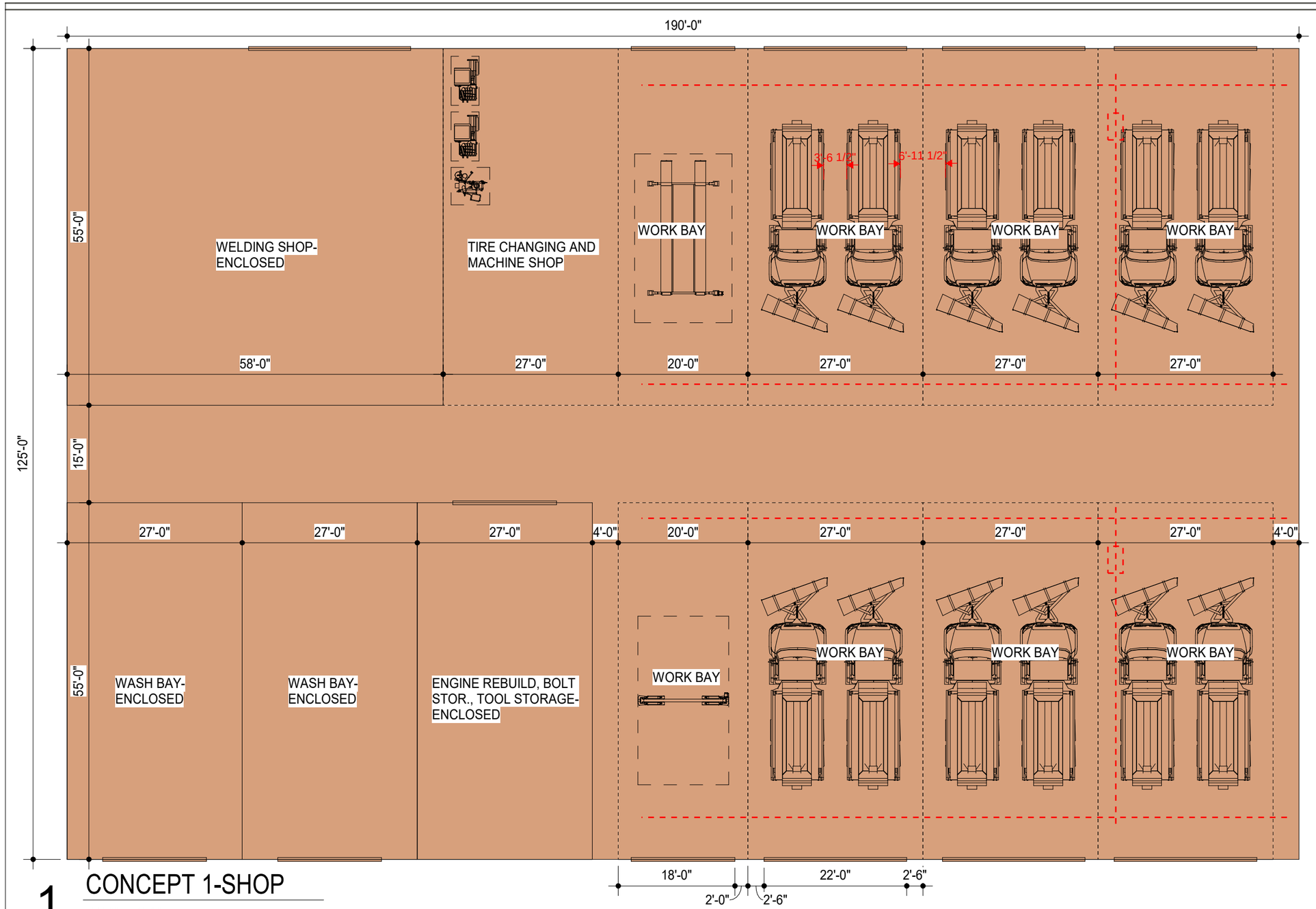
HTK ARCHITECTS

2.0	**ADMINISTRATION**								
2.1	**Director & Engineering**					**1,700**			
2.1.1	District 1 HQ-Mark					130			
2.1.2	Office Receptionist					350			Front reception area w/ building lobby
2.1.3	Surveyor					130			Consider surveyors as one suite
2.1.4	Surveyor					130			
2.1.5	Construction Engineer					130			Consider engineers as one suite
2.1.6	Construction Engineer					130			
2.1.7	District Engineer					220			
2.1.8	Senior Administrator Asst-Carla					250			Incl. additional work area
2.1.9	Safety Specialist					230			needs storage-shirts, etc. 10x10
2.2	**Public Affairs, HR, Accounting**					**2,940**			
2.2.1	Office Coordinator					130			
2.2.2	Public Affairs					130			Consider public affairs as one suite
2.2.3	Public Affairs					130			
	Public Affairs Storage					100			
2.2.4	Accounting					130			
2.2.5	Accounting					130			Consider acconting as one suite
2.2.6	Accounting					130			
2.2.7	Human Resources-manager					220			Private office
2.2.8	Human Resources					130			Private office
	Human Resources					130			
2.2.9	Future Offices					780	6		
2.2.10	HR/Accounting Storage					800			If not located in suite, in centralized storage room but secured from other storage
2.3	**Information Technology**					**990**			
2.3.1	IT Office					130			Consider IT as one area suite
2.3.2	IT Office					130			Help desk
2.3.3	Computer Tech					130			IT work area and storage
2.3.4	IT Workroom					400			
2.3.5	IT Storage					200			
2.4	**Conference & Training + Support**					**6,900**			
2.4.1	Large Conference/Training Room	2,295				2,600			Training room for 100
2.4.2	Admin Conference (12 person)					400			testing-up to 20
2.4.3	Small Conference (4 person)					200			
2.4.4	Breakroom					450			Admin office break room
2.4.5	Private room					130			Nursing mothers room
2.4.6	Plan File Storage					2,320			
2.4.7	Admin Workroom					500			Incl. mail processing
2.4.8	Training Storage					150			
2.4.9	Large Conf./Training Kitchen					150			Separate room near training

2.5	**ADMINISTRATION BUILDING SUPPORT**					**920**			
2.5.1	Restrooms					400			M / F + 1 or 2 single occupancy dedicated to admin and office areas
2.5.2	Mechanical					200			If admin is built as a separate phase, will need dedicated mech & elec rooms. Rooms sized per system requirements
2.5.3	Electrical					100			
2.5.4	Data					70			
	Custodian					150			

2.6	**EXTERIOR COMPONENTS-ADMINISTRATION**								
2.6.1	POV Parking								60 parking for admin
2.6.2	Outdoor Area								Outdoor gathering, potential outdoor eating

ADMIN								
SUBTOTAL					13,450			
Grossing factor	50%				6,725			
TOTAL					**20,175**			



1 CONCEPT 1-SHOP

1/16" = 1'-0"

23,750 SF

Double Bay - 27 x 55 (6)

Weld
Tire
Wash (2)
Engine
Lift (2)

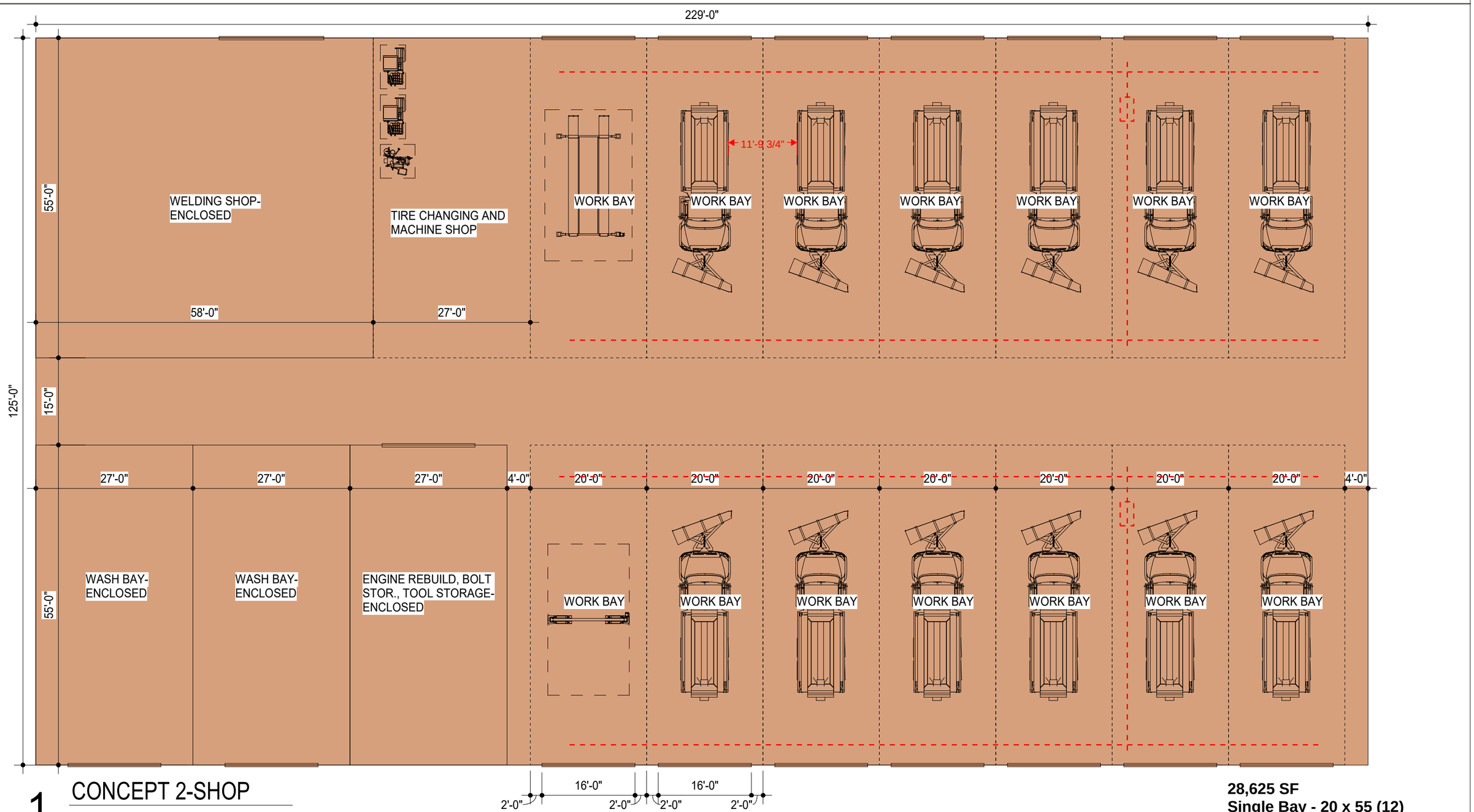
Bridge Crane - __T
Coverage 4 bays (2)

HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

02/26/23



1 CONCEPT 2-SHOP

1/16" = 1'-0"

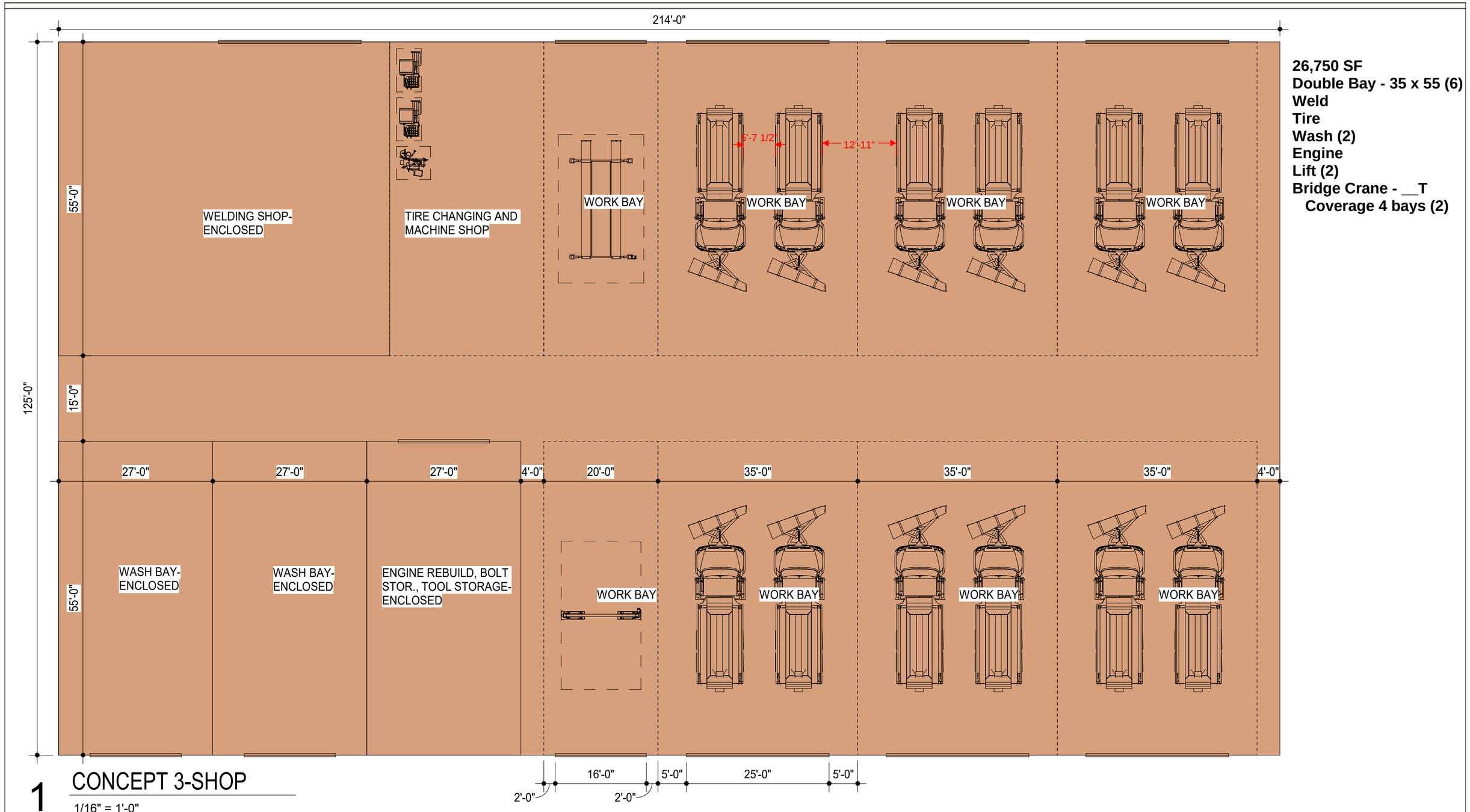
28,625 SF
Single Bay - 20 x 55 (12)
Weld
Tire
Wash (2)
Engine
Lift (2)
Bridge Crane - __T
Coverage 7 bays (2)

HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

02/26/23



1 CONCEPT 3-SHOP

1/16" = 1'-0"

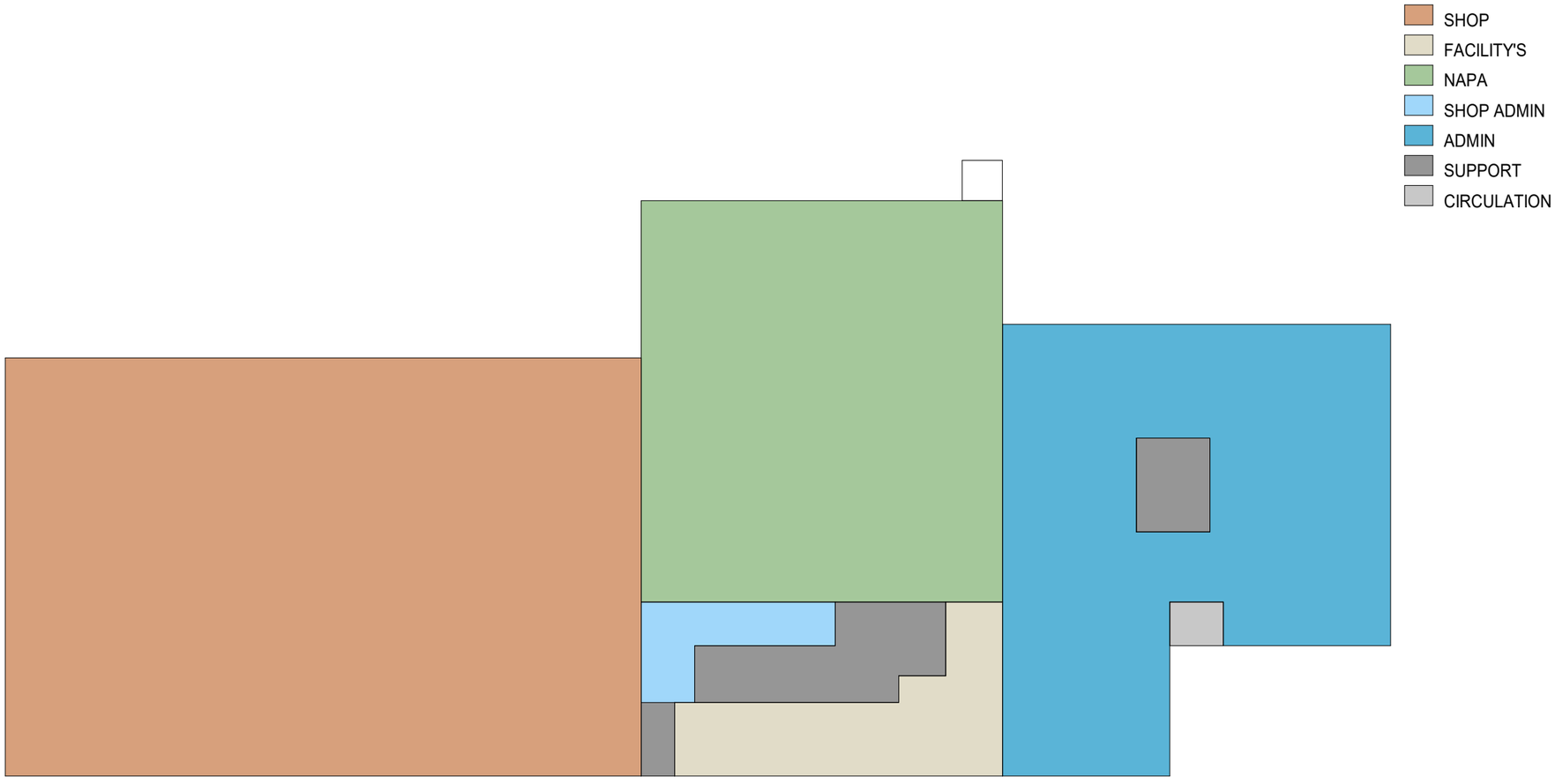
26,750 SF
Double Bay - 35 x 55 (6)
Weld
Tire
Wash (2)
Engine
Lift (2)
Bridge Crane - __T
Coverage 4 bays (2)

HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

02/26/23



1 CONCEPT 1-OVERALL

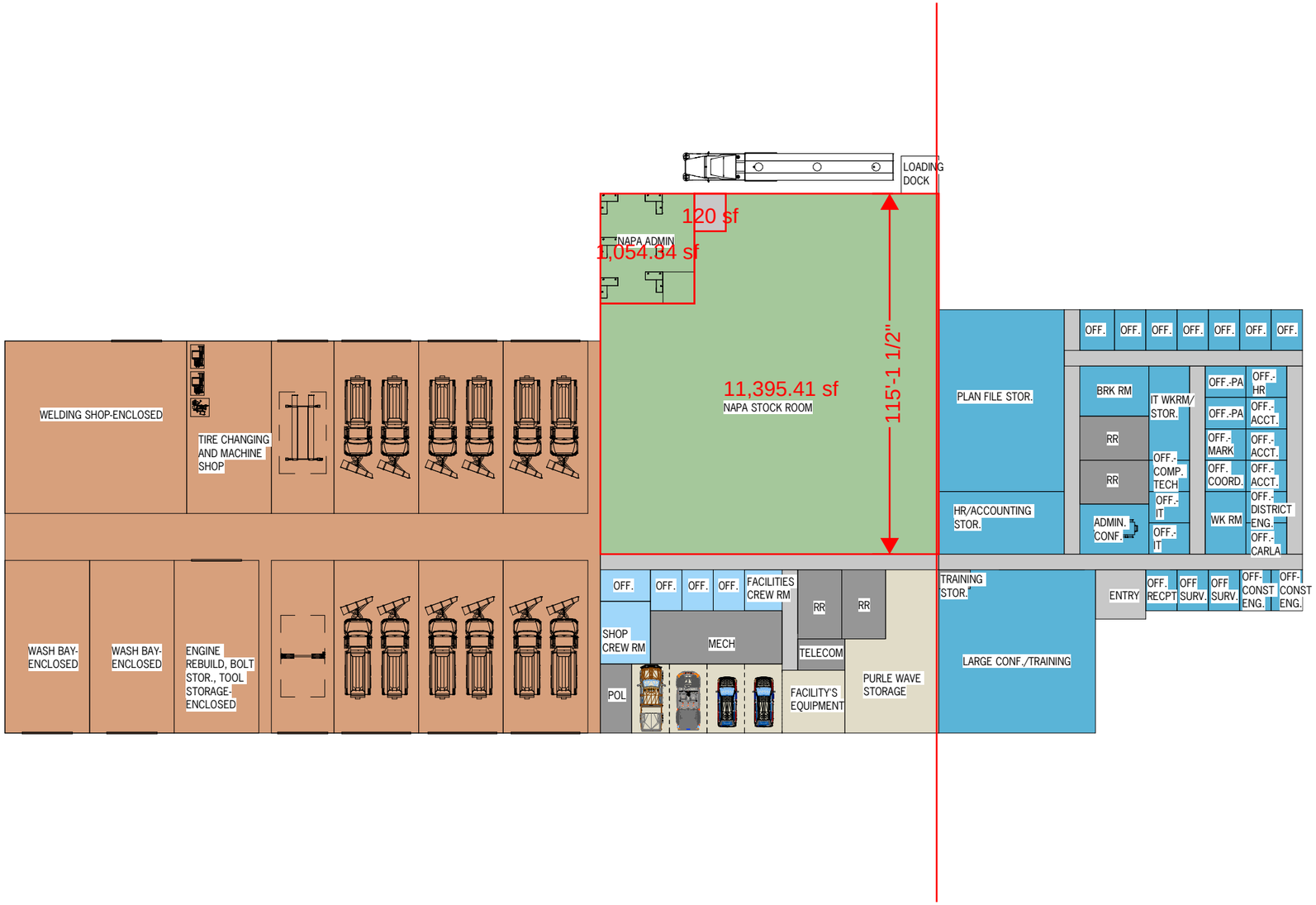
1" = 40'-0"

HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

02/26/23



1 CONCEPT 1-DETAIL

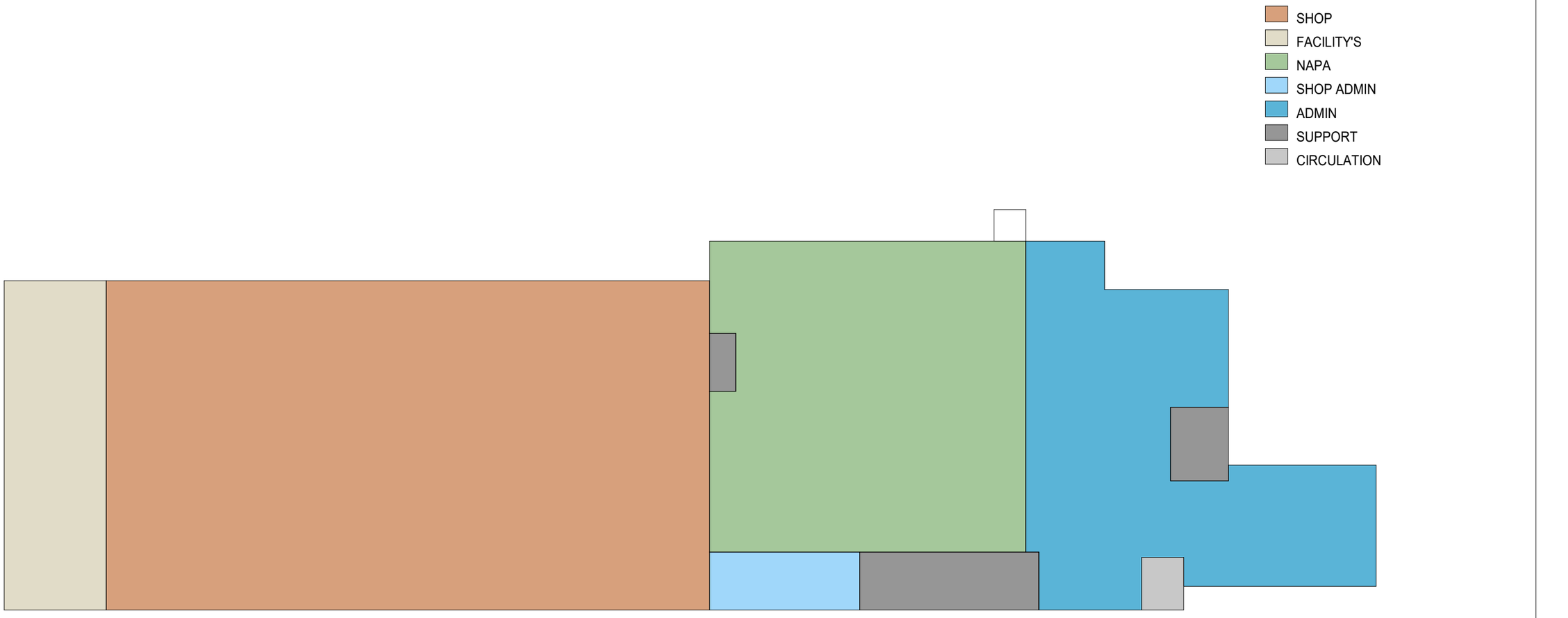
1" = 40'-0"

HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

02/26/23



1 CONCEPT 2-OVERALL

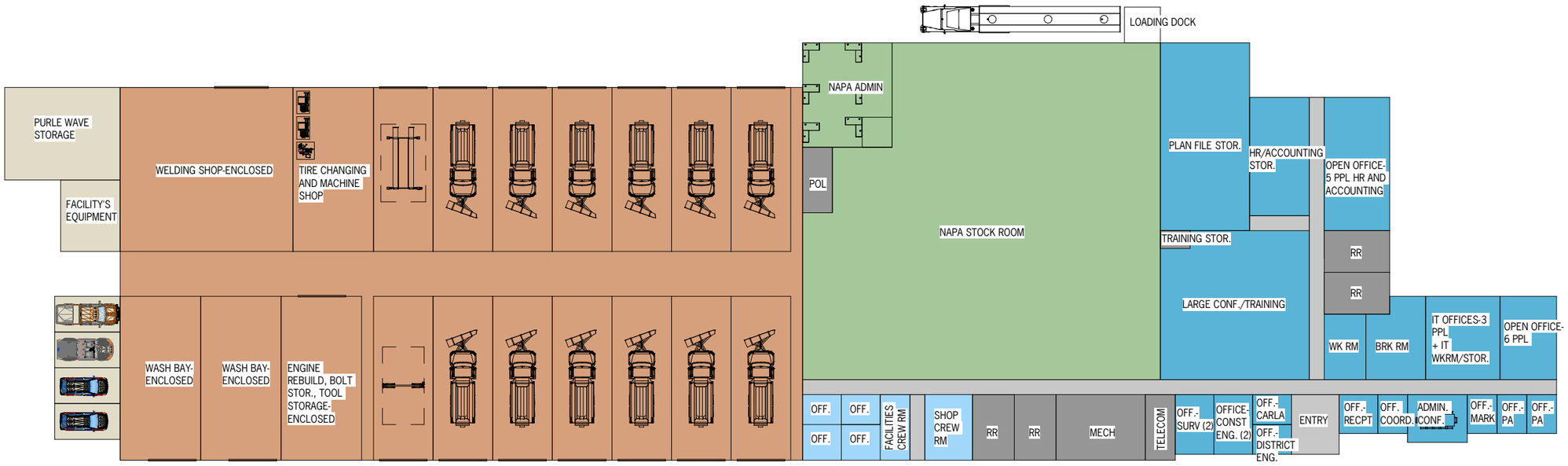
1" = 40'-0"

HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

02/26/23



1 CONCEPT 2-DETAIL

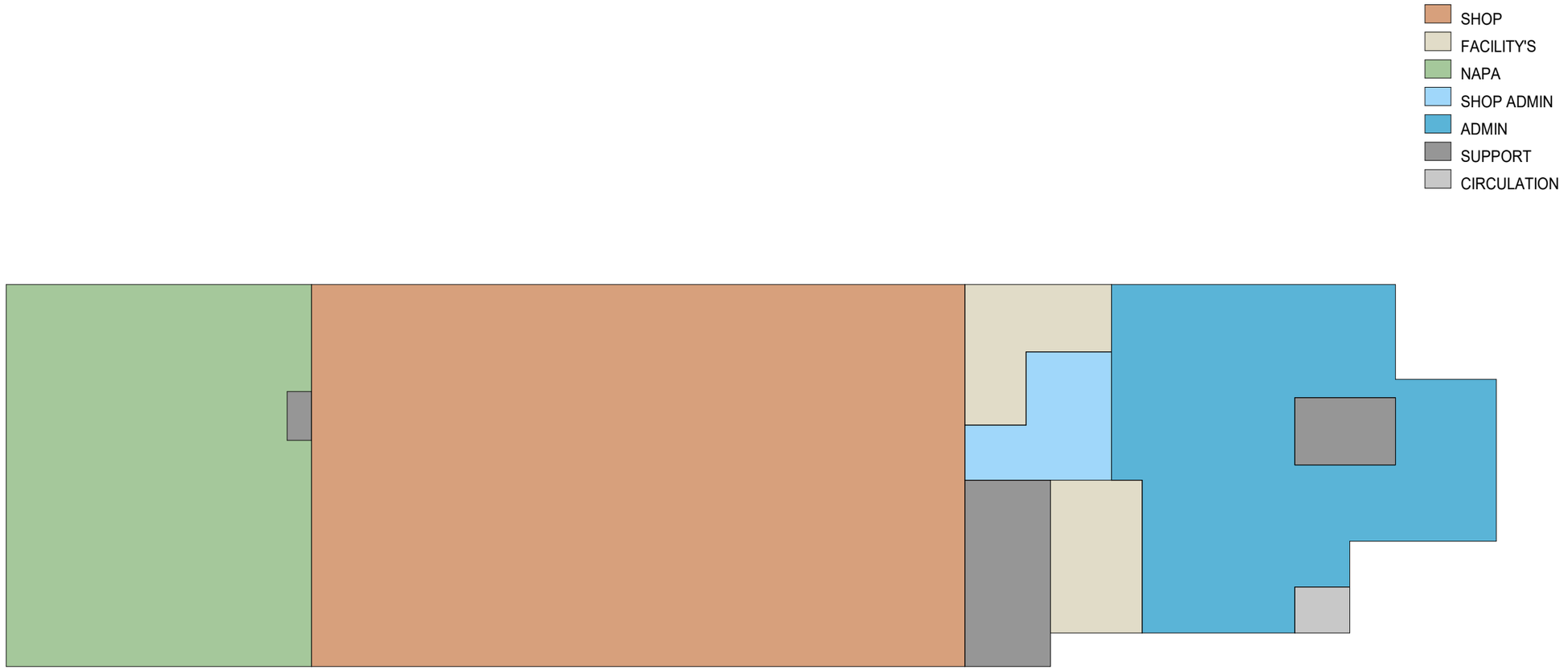
1" = 40'-0"

HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

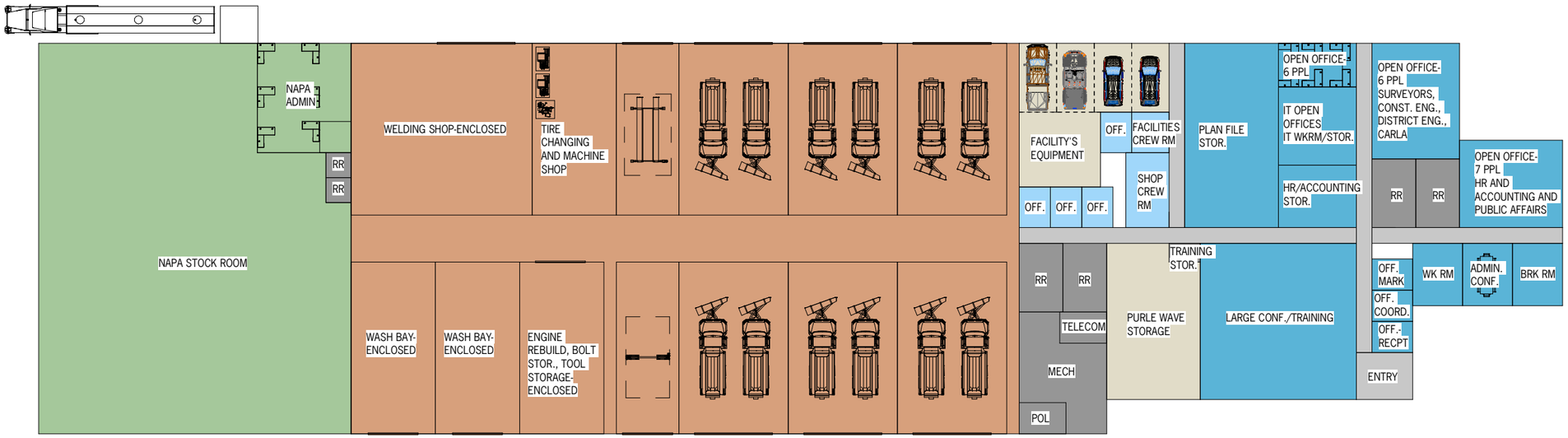
KDOT

02/26/23



1 CONCEPT 3-OVERALL

1" = 40'-0"



1 CONCEPT 3-DETAIL

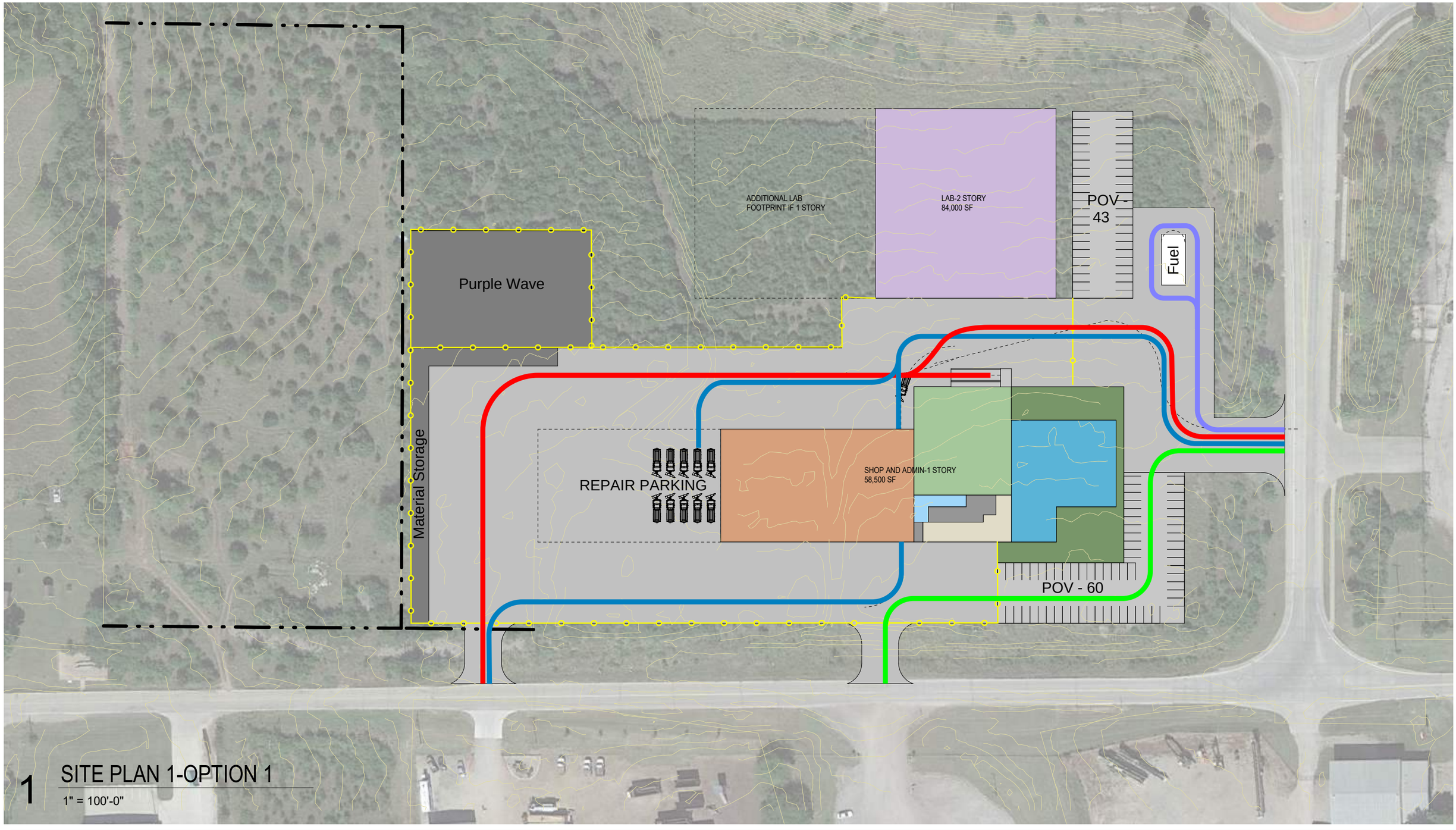
1" = 40'-0"

HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

02/26/23



1 SITE PLAN 1-OPTION 1

1" = 100'-0"

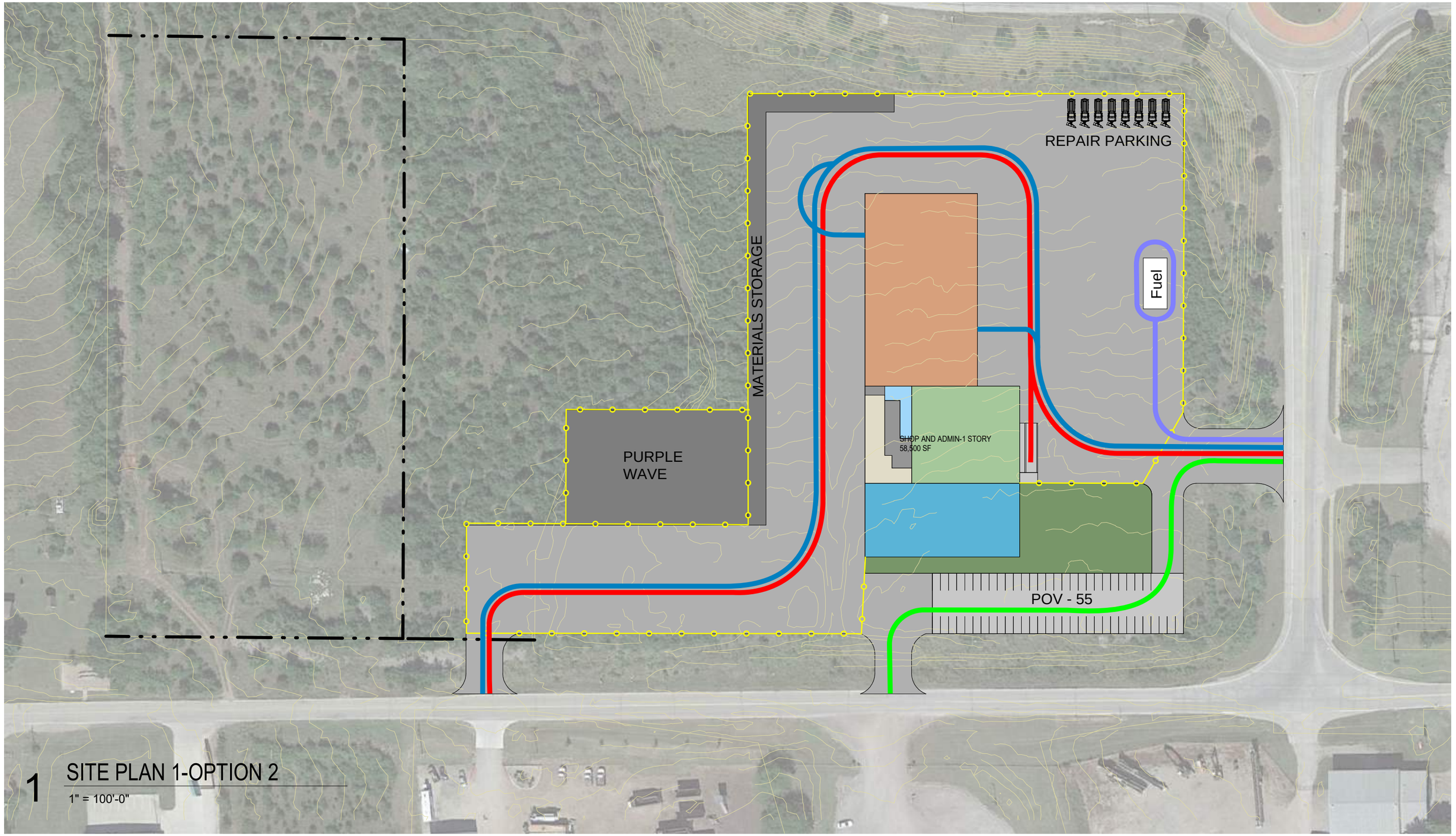
HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

05/23/23

NORTH



1 SITE PLAN 1-OPTION 2

1" = 100'-0"

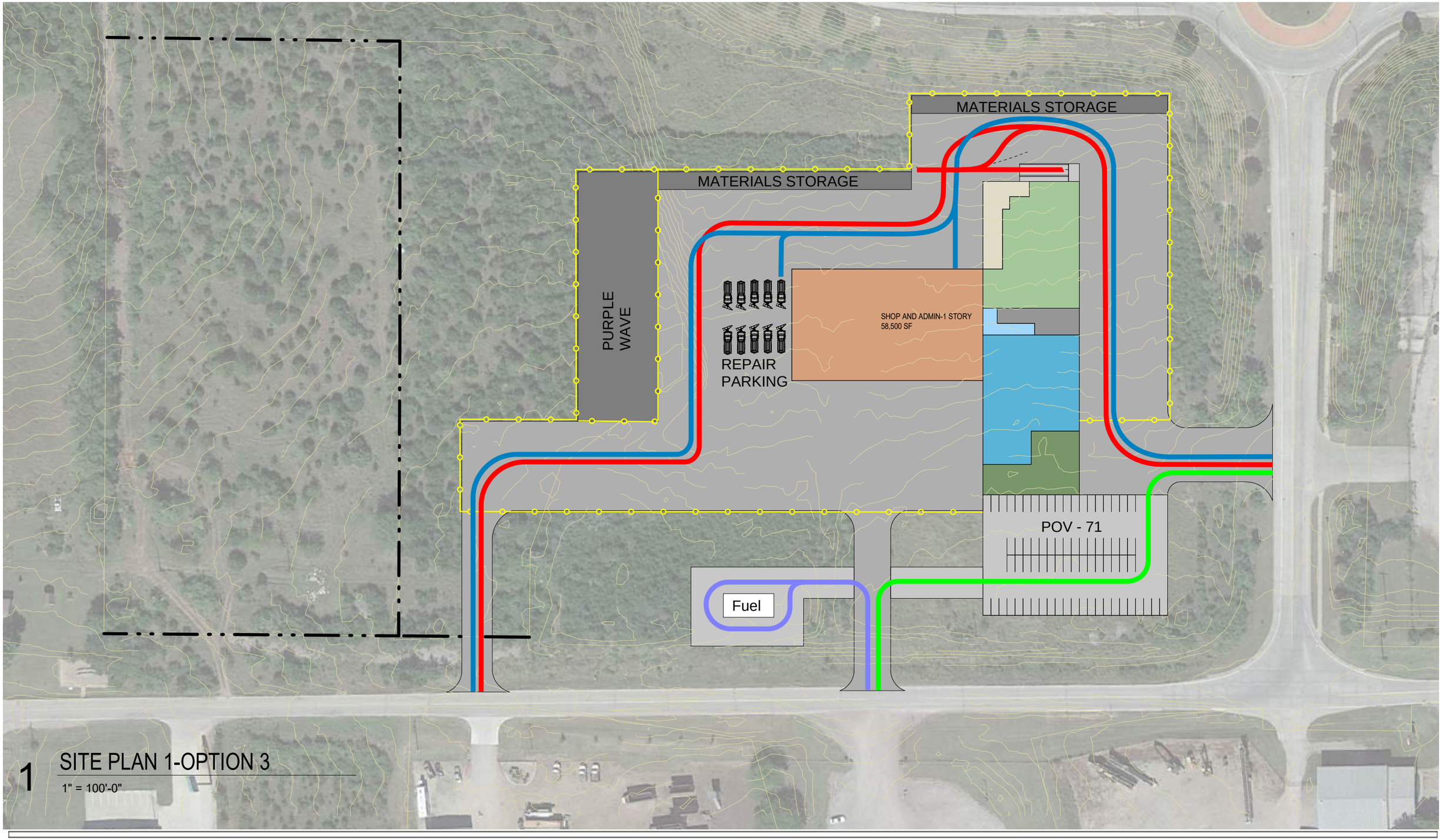
HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

05/23/23

NORTH



1 SITE PLAN 1-OPTION 3

1" = 100'-0"

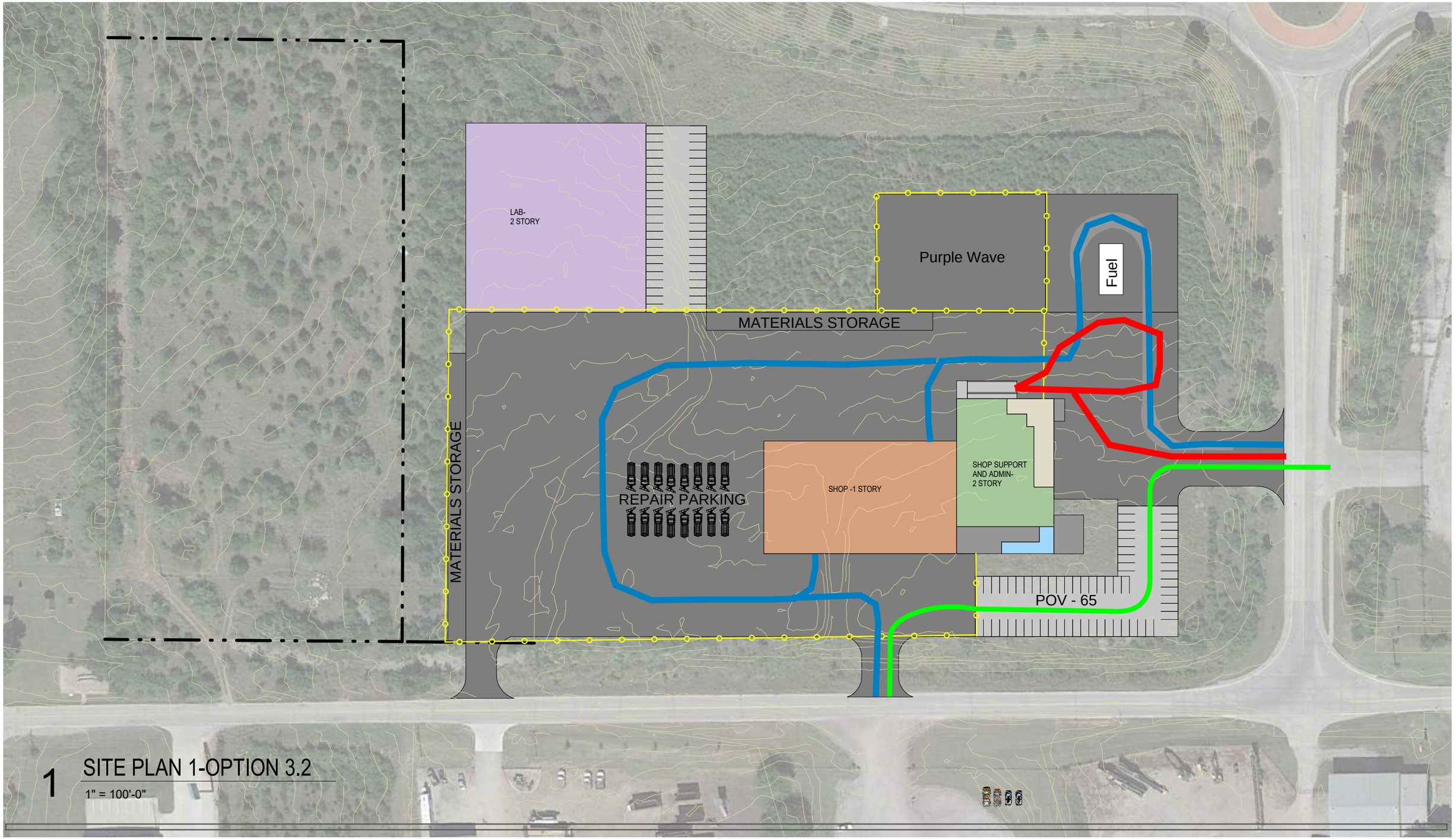
HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

05/23/23

NORTH



1 SITE PLAN 1-OPTION 3.2

1" = 100'-0"

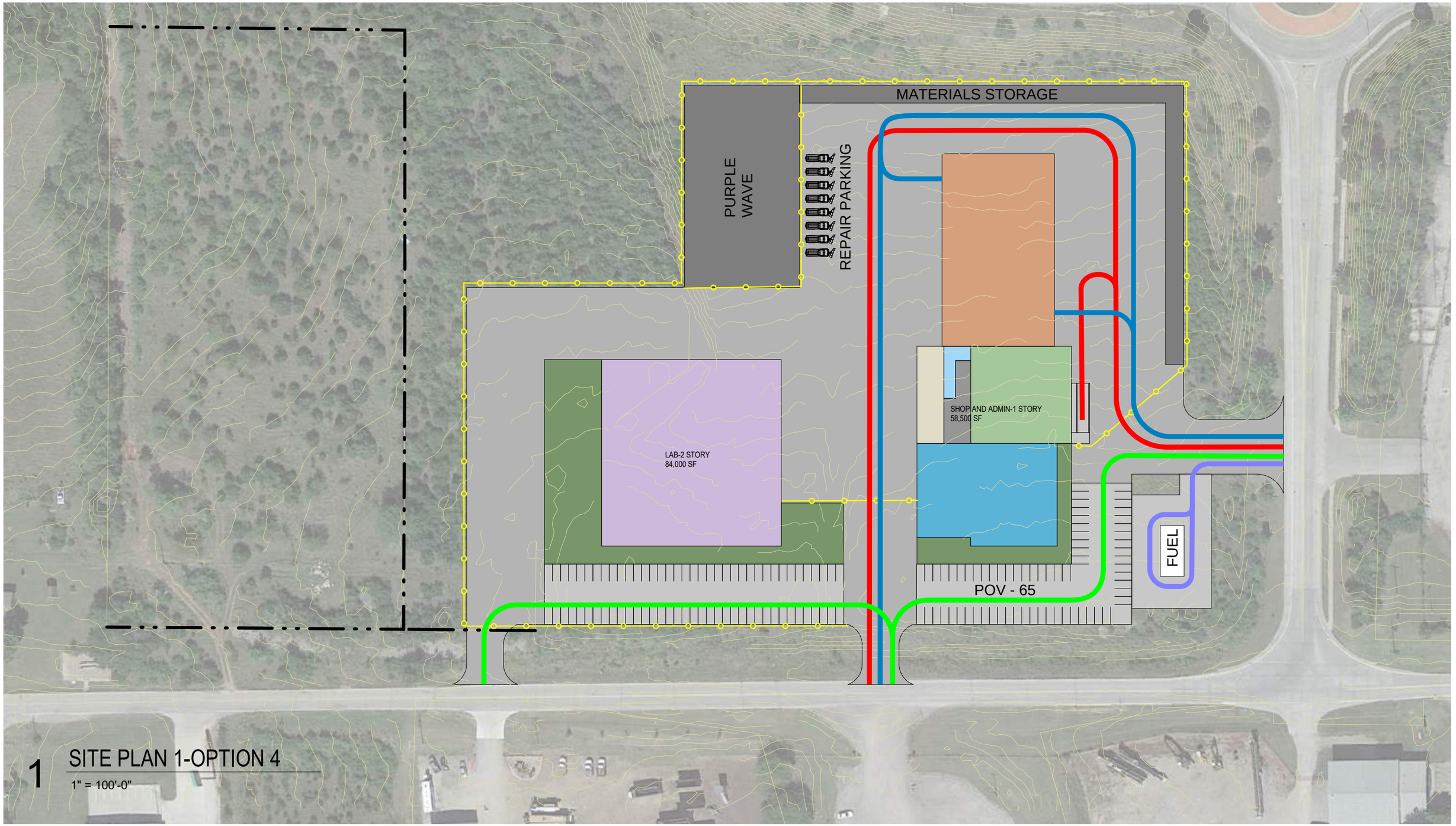
HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

06/13/23

NORTH



1 SITE PLAN 1-OPTION 4

1" = 100'-0"

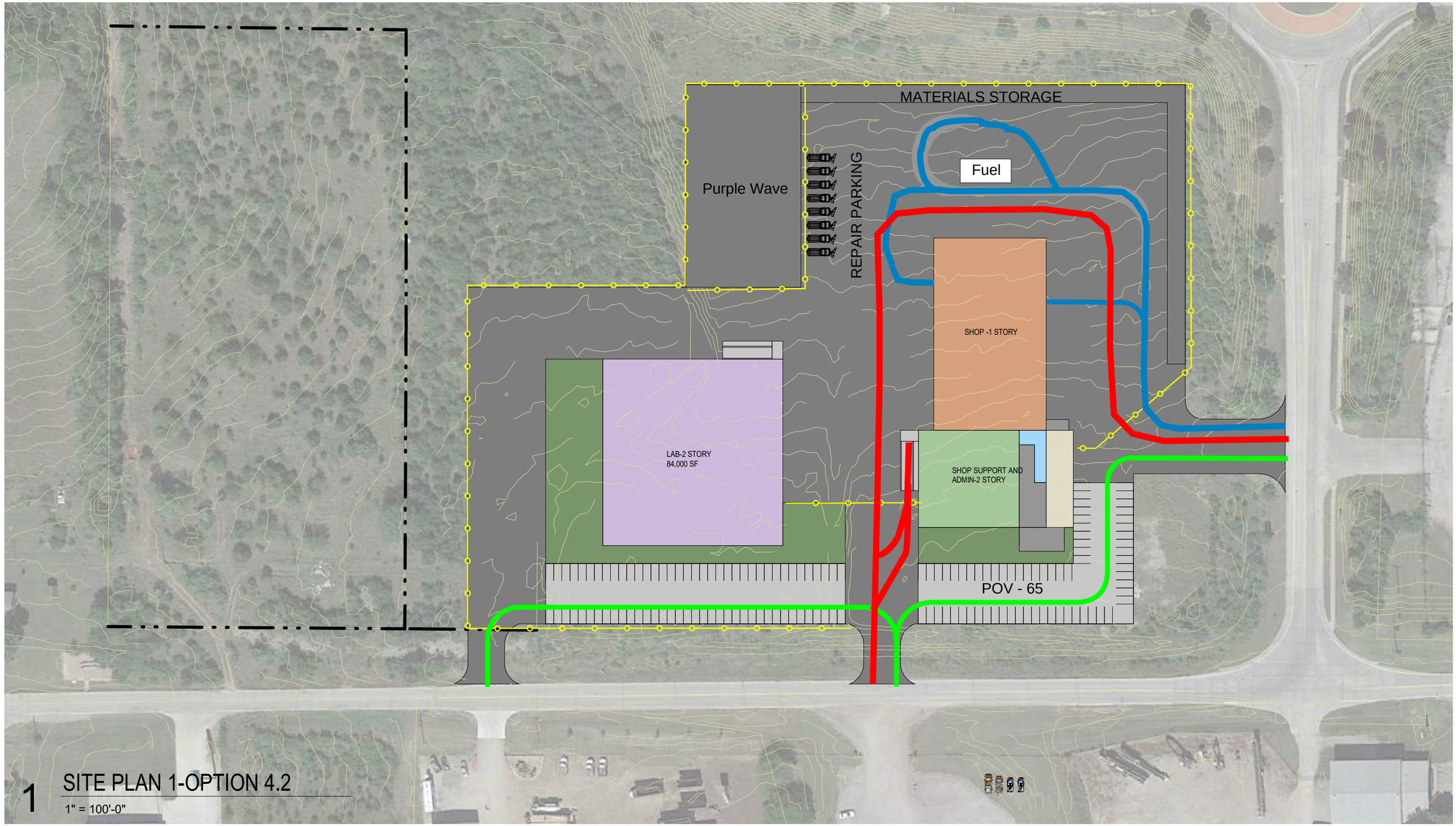
HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

05/23/23

NORTH



1 SITE PLAN 1-OPTION 4.2

1" = 100'-0"

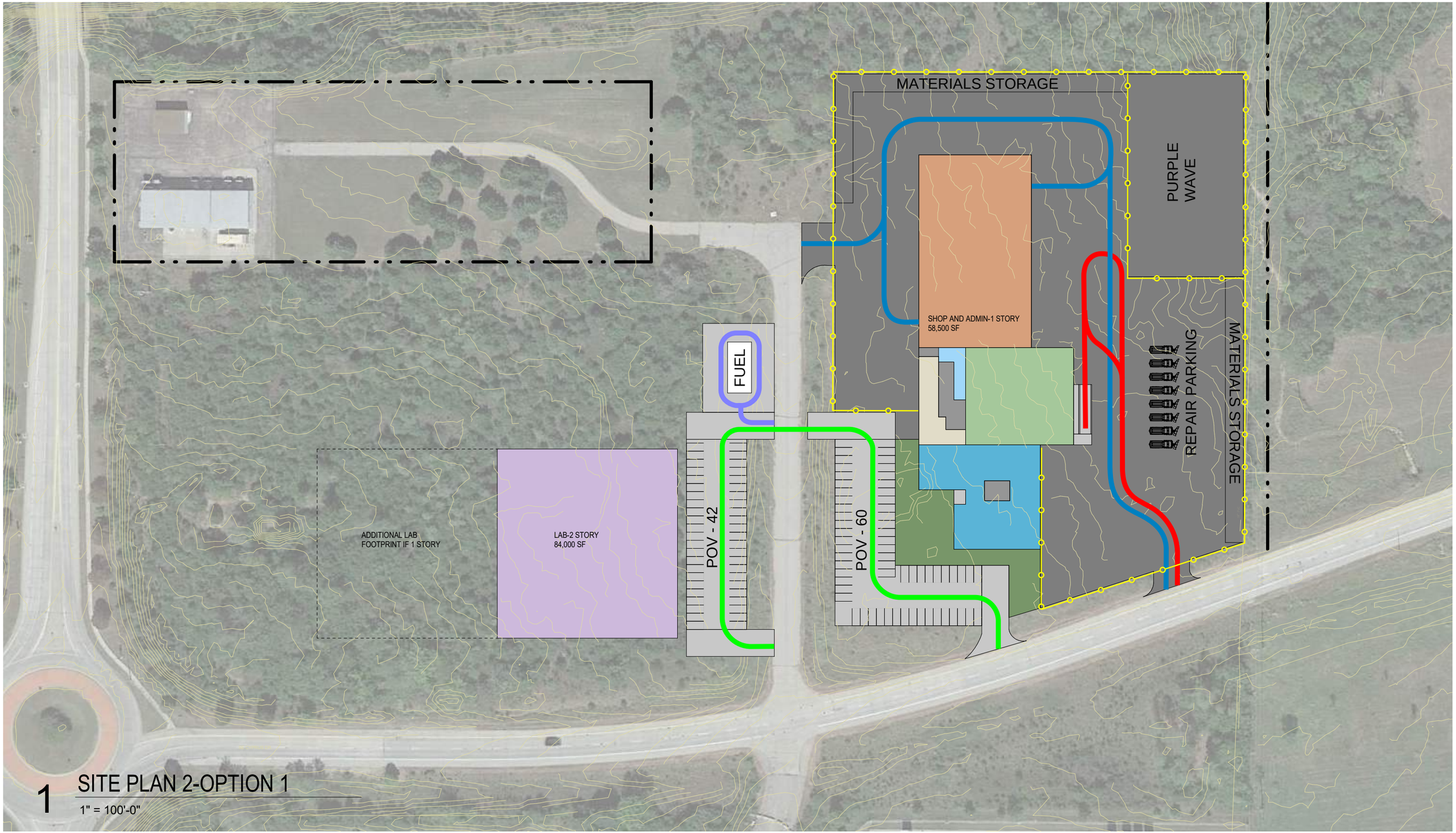
HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

06/13/23

NORTH



1 SITE PLAN 2-OPTION 1

1" = 100'-0"

HTK ARCHITECTS

KDOT DISTRICT 1 HQ PROGRAMMING

KDOT

05/23/23

NORTH

KDOT DISTRICT 1 HQ-PROGRAMMING ESTIMATE

Appendix F

		CONSTRUCTION COST ESTIMATE					ADDITIONAL PROJECT COSTS				
	SCOPE ITEM	QTY (SF/EA/LF)	UNIT COST	EQUIPMENT	CONST. TOTAL	FF&E	TECHNOLOGY/AV	CONTINGENCY	TOTAL ESTIMATE	SCOPE NOTES
Building										
	Shop	51,100	$ 305.00	$ 225,000.00	$ 15,810,500.00	$ 30,000.00	$ 25,000.00	$ 1,586,550.00	$ 17,452,050.00	
	Administration	20,000	$ 325.00		$ 6,500,000.00	$ 150,000.00	$ 520,000.00	$ 717,000.00	$ 7,887,000.00	Crane, compressor, wash bay equipment
Site										
	Concrete Aprons	18,000	$ 13.56		$ 244,080.00			$ 24,408.00	$ 268,488.00	
	Yard Paving	175,000	$ 8.00		$ 1,400,000.00			$ 140,000.00	$ 1,540,000.00	prefer this as 8" asphalt
	Purple Wave Millings	70,000	$ 4.10		$ 287,000.00			$ 28,700.00	$ 315,700.00	
	Sandbox-Equipment Testing	10,000	$ 1.25		$ 12,500.00				$ 12,500.00	
	POV Parking	21,000	$ 5.10		$ 107,100.00			$ 10,710.00	$ 117,810.00	
	Dock	1	$ 150,000.00		$ 150,000.00			$ 15,000.00	$ 165,000.00	
	Fuel Islands	2	$ 35,000.00		$ 70,000.00				$ 70,000.00	
	Entry Drives	12,000	$ 13.56		$ 162,720.00				$ 162,720.00	
	Fence-Chainlink	1,600	$ 32.00		$ 51,200.00				$ 51,200.00	
	Fence-Decorative	750	$ 65.00		$ 48,750.00				$ 48,750.00	
	Gates	3	$ 15,000.00		$ 45,000.00				$ 45,000.00	
	Earthwork	1	$ 350,000.00		$ 350,000.00			$ 35,000.00	$ 385,000.00	Estimate-need geotech
	Generator-full load	1	$ 275,300.00		$ 275,300.00			$ 27,530.00	$ 302,830.00	
	Generator-50% load	1	$ 162,000.00		$ 162,000.00			$ 16,200.00	$ 178,200.00	
	Generator-30% load	1	$ 65,000.00		$ 65,000.00			$ 6,500.00	$ 71,500.00	
	Water 2" Domestic	300	110.00		$ 33,000.00				$ 33,000.00	
	Water 6" Fire	600	$ 145.00		$ 87,000.00				$ 87,000.00	Need pressure and flow
	Fire Hydrants	2	$ 6,000.00		$ 12,000.00				$ 12,000.00	test
	Gas	1	$ 10,000.00		$ 10,000.00				$ 10,000.00	
	Communications	1	$ 10,000.00		$ 10,000.00				$ 10,000.00	
	Sanitary Sewer 8"	300	$ 265.00		$ 79,500.00				$ 79,500.00	
	Power	1	$ 15,000.00		$ 15,000.00				$ 15,000.00	
	Storm Water 24" HDPE	500	$ 156.00		$ 78,000.00				$ 78,000.00	
Total					$ 26,065,650.00			$ 2,607,598.00	$ 29,398,248.00	
	Sanitary Sewer Extension	1	$ 900,000.00		$ 900,000.00			$ 90,000.00	$ 990,000.00	
					$ 3,755,150.00					

Appendix G-Photos

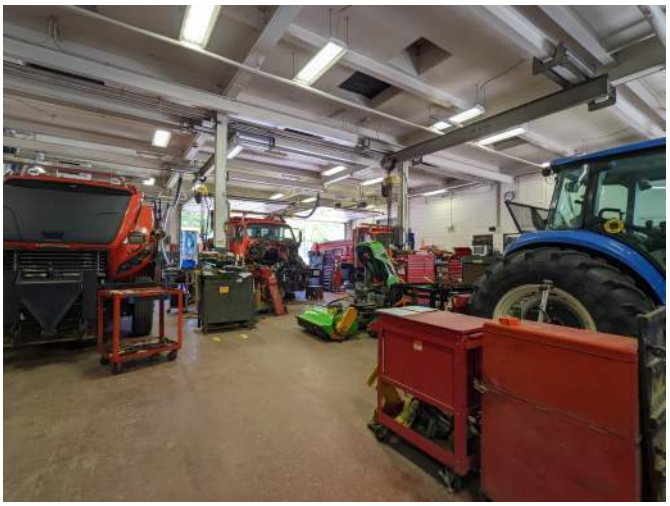
East Bay Shop

East Bay Shop

West Bay Shop

West Bay Shop

West Bay Shop

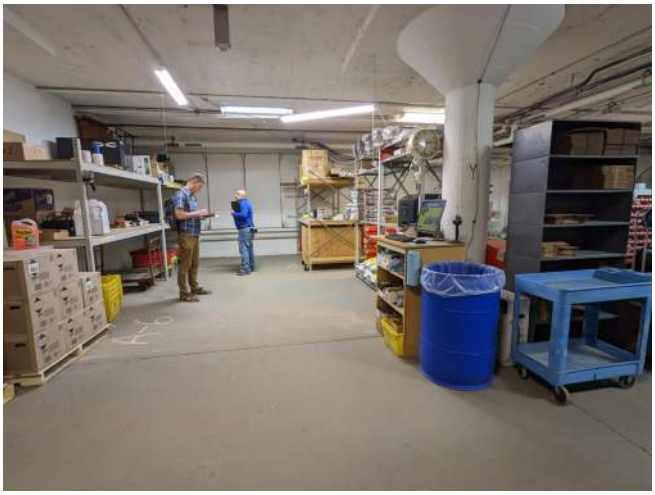


West Bay Shop

Welding

Tire Area

Supply-Basement



Supply-Basement

Supply-Basement Order Fullment

Supply-Main Level Service Window

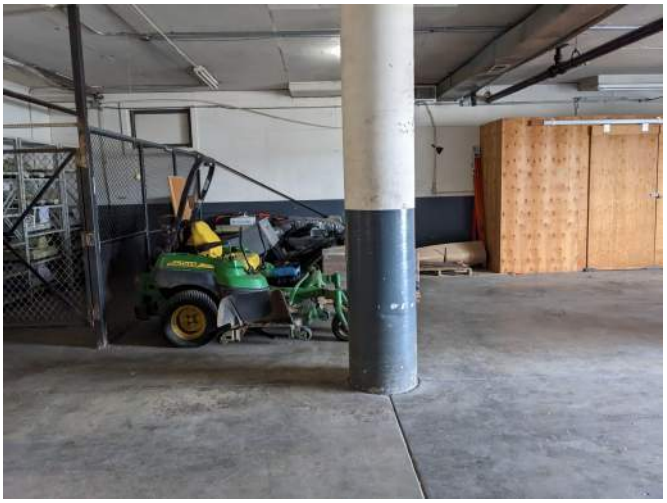
Supply-Office

Supply-Office

Facilities Storage and Vehicle

Facilities Storage and Vehicle

Facilities Storage



Facilities Storage

Purple Wave Storage

Purple Wave Storage

IT Work Station

IT Work Station

Survey Office

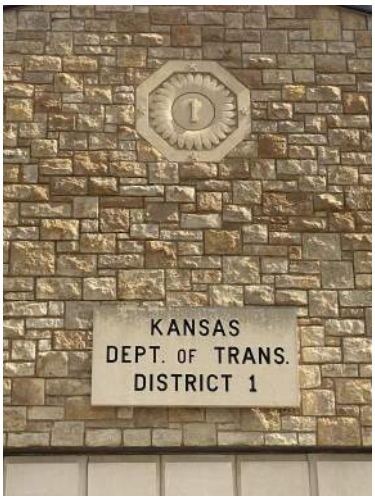
Survey Office

Basement-Conference Room

Basement-Records Storage

Main Level-Training/Conference Room

Main Level-Training/Conference Room



Exterior-Stone

Exterior-Stone/Conference Room Entry

Exterior-Yard

Exterior-Dock

GEOTECHNICAL ENGINEERING REPORT

KDOT District 1 Office and Lab Buildings
S ½ SE ¼ SW ¼ of Section 3, T12S, R16E
Topeka, Kansas
CFS Project No. 23-5162

Prepared For
Kansas Department of Transportation
District 1, Area Four Office
101 SW Gage Boulevard
Topeka, Kansas 66606

August 29, 2023

Prepared by:
Cook, Flatt & Strobel Engineers, P.A.
2011 NW Topeka Boulevard
Topeka, Kansas 66608
785.670.6447

One Vision. One Team. One Call.

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Holton, Kansas
Kansas City, Kansas
Kansas City, Missouri
Springfield, Missouri
Jefferson City, Missouri

August 29, 2023

Mr. Zach Snethen
HTK Architects
900 S Kansas Avenue, STE 200
Topeka, Kansas 66612

Subject: Geotechnical Engineering Report
KDOT District 1 Office and Lab Buildings
S ½ SE ¼ SW ¼ of Section 3, T12S, R16E
Topeka, Kansas
Project No. 23-5162

Dear Mr. Snethen:

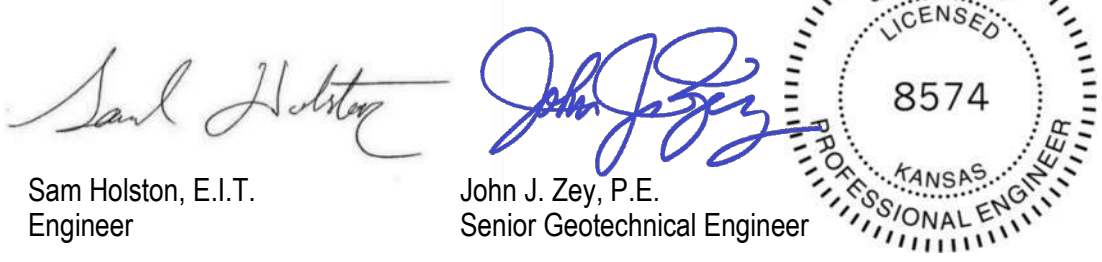
We have completed the subsurface exploration and geotechnical engineering evaluation for the above-referenced project. The purpose of the geotechnical study was to explore and evaluate the subsurface conditions at the proposed project site and, based on this information to provide geotechnical recommendations for foundation design and site development for the proposed buildings and pavement areas.

In summary, the borings encountered undocumented fill and naturally deposited clay soils underlain by limestone and shale that continued to the depths explored. We have recommended that the proposed buildings be supported on shallow spread footings that bear in stiff, natural clay soils, weathered shale bedrock and/or in controlled structural fill. Specific recommendations for design and construction of foundations are presented in the following report.

This report completes our current scope of geotechnical services for this project. The enclosed report describes our exploration procedures and presents the results of the testing and evaluation along with design and construction recommendations for this project. We appreciate the opportunity to work with you on this project and are prepared to provide the recommended construction services.

Respectfully submitted,

Cook, Flatt & Strobel Engineers, P.A.



Sam Holston, E.I.T.
Engineer

John J. Zey, P.E.
Senior Geotechnical Engineer

[redacted]

TABLE OF CONTENTS

GEOTECHNICAL ENGINEERING REPORT
KDOT DISTRICT 1 OFFICE AND LAB BUILDINGS
S ½ SE ¼ SW ¼ OF SECTION 3, T12S, R16E
TOPEKA, KANSAS

Project No. 23-5162
August 29, 2023

INTRODUCTION

CFS Engineers has completed the subsurface exploration and geotechnical engineering evaluation of the site for the proposed KDOT District 1 office and lab buildings, which will be located at the northwest corner of the intersection of SE 21st Street and SE Rice Road in Topeka, Kansas. Our services for this project were performed in general accordance with our proposal. Mr. Zach Snethen with HTK Architects authorized the exploration work by signing our proposal/contract.

PROJECT DESCRIPTION

We understand that the proposed lab building will be a two-story, steel-frame structure, with a grade supported lower level floor slab. The building will have a footprint of about 42,000 square feet, for a total of 84,000 square feet, as shown on Figure 1 in the Appendix. Foundation loads for the new building were not known at the time our report was prepared. Based on the building type and anticipated column spacing, we have assumed that maximum foundation loads will be less than 150 kips for isolated columns and 5 kips per lineal foot for load bearing walls. The finished floor elevation of the proposed building had not been determined at the time our report was prepared. There is about 10 feet of elevation change across the building footprint, and we have assumed that 5 to 6 feet of cut and/or fill will be needed to develop finished grades in the proposed building area. No other specific information was known about the proposed lab building at the time our report was prepared.

We understand that the proposed shop building will be connected to the administrative building. The shop and administrative buildings will have an overall footprint of about 58,500 square feet. The shop and administrative

buildings will be single-story buildings, with grade supported floor slabs. Foundation loads for the proposed buildings were not known at the time our report was prepared. Based on the building type and anticipated column spacing, we have assumed that maximum foundation loads will be less than 75 kips for isolated columns and 3 kips per lineal foot for load bearing walls. The finished floor elevations of the proposed shop and administrative buildings had not been determined at the time our report was prepared. There is an existing mound of fill at this location as well as about 8 feet of elevation change between the opposite corners of the footprints of the proposed shop and administrative buildings. Therefore, we have assumed that, after removing the mound of fill, there will still be up to 3 to 5 feet of cut and/or fill will be needed to develop finished grades in the proposed shop and administrative building areas.

It is our understanding that a small shed is planned west of the shop building, and another shed is planned east of the lab building. The sheds will have overall dimensions of approximately 25 feet by 55 feet, and will be single-story structures, with grade supported floor slabs. Foundation loads and finished floor elevations were not known and had not been determined at the time this report was prepared. Based on the building types, we have assumed foundation loads will be less than 25 kips for columns and 2 kips per lineal foot for load bearing walls. We have assumed that the floor slab for the shed will approximately match existing site grades and will require less than 3 feet of cut and/or fill to develop finished grades in the proposed shed area.

In addition, light duty parking lots are planned for the areas east of the lab building and on the south and east sides of the administrative building. The parking lots will provide space for about 110 automobiles and other light personnel vehicles. A large portion of the remainder of the site will be paved. The type of traffic that the pavement will support include light personnel vehicles and KDOT dump trucks. No other specific information was provided regarding the new pavement.

The scope of the exploration and engineering evaluation for this study, as well as the conclusions and recommendations in this report, were based on our understanding of the project as described above. If pertinent details of the project have changed or otherwise differ from our descriptions, we should be notified and engaged to review the changes and modify our recommendations, if needed.

DRILLING AND SAMPLING PROCEDURES

The field work for this project was performed between July 26 and August 15, 2023. Twenty exploratory test borings were drilled across the site. Figure 1 in the Appendix shows the approximate locations of the borings with reference to the proposed building lines and existing site features. The boring locations were staked by the field engineer. Distances from the existing city streets to the boring locations were measured using a calibrated wheel. Right angles for locating the borings were estimated. The coordinates and surface elevations shown on the individual boring logs were determined by CFS Engineers using geodetic survey methods upon completion of the borings.

The borings were performed with a truck-mounted, Diedrich D-50 rotary drill rig, using 4-inch diameter flight augers to advance the boreholes. Representative samples of the overburden soils and bedrock units were obtained at selected intervals using the Shelby tube and split-barrel sampling procedures as outlined in ASTM Specifications D-1587 and D-1586, respectively. The Shelby tube sampling procedure utilizes a thin-walled, steel tube with a sharp cutting edge that is pushed hydraulically into the bottom of the boring to obtain relatively undisturbed samples of cohesive or moderately cohesive soils. The samples were sealed and returned to our laboratory for further examination, classification and testing.

The split-barrel sampling procedure utilizes a standard 2-inch O.D. split-barrel sampler that is driven into the bottom of the boring with an automatic hammer. The number of blows required to advance the sampler the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Resistance Value (N). These "N" values are indicated on the boring logs at their depth of occurrence and provide an indication of the consistency of clays and the relative hardness of weathered bedrock units. A higher efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the Standard Penetration Resistance Values (N). The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report. The split-barrel samples were placed in plastic bags and returned to our laboratory for further examination, classification and testing.

Boring logs are included in the Appendix of this report and present such data as soil and bedrock descriptions, consistency and relative hardness evaluations, depths, sampling intervals and observed groundwater conditions. Conditions encountered in each of the borings were monitored and recorded by the drill crew. Field logs were prepared by the drill crew that included visual classification of the materials encountered during drilling, as well as drilling characteristics. Our final boring logs represent the geotechnical engineer's interpretation of the field logs combined with laboratory observation and testing of the samples. Stratification boundaries indicated on the boring logs were based on observations during our field work, an extrapolation of information obtained by examining samples from the borings and comparisons of soils and/or bedrock types with similar engineering characteristics. Locations of these boundaries are approximate, and the transitions between soil and bedrock types may be more gradational in nature rather than clearly defined.

LABORATORY TESTING PROGRAM

The laboratory testing program consisted of performing water content, dry unit weight and unconfined compression tests on representative portions of undisturbed samples obtained with the Shelby tube sampler. A calibrated hand penetrometer was used to determine the approximate unconfined compressive strength of samples that were deformed or otherwise unsuitable for unconfined compression testing. The hand penetrometer has been correlated with unconfined compression tests, and provides a better estimate of the consistency and strength than visual observation alone. Moisture content determinations were also performed on samples obtained using the split-barrel sampler. The results of the laboratory tests are presented on the respective boring logs.

In addition, Atterberg Limits tests were conducted on selected samples of the onsite soils. These tests provide information on the plasticity of the soil, which is a basis for soil classification and for estimating the potential of subgrade soils to change volume with variations in moisture content. Results of these tests are also indicated on the respective boring logs.

As part of the testing program, the soil samples were classified by a geotechnical engineer using visual and manual procedures outlined in ASTM D-2487 and D-2488. The descriptions of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Estimated

group symbols according to the Unified Soil Classification System are shown on the boring logs. A brief description of this classification system is included in the Appendix of this report.

The bedrock units encountered in the borings were described in accordance with the enclosed General Notes for Bedrock based on visual classification of disturbed auger cuttings, split-barrel samples and drilling characteristics. Core samples and petrographic analysis may reveal other rock types.

SITE AND SUBSURFACE CONDITIONS

The proposed buildings will be located at the northwest corner of the intersection of SE 21st Street and SE Rice Road in Topeka, Kansas. The site was bounded on the north by the onramp and offramp to I-70, on the east by SE Rice Road, on the south by SE 21st Street and on the west by a tree line. At the time the borings were performed, about ¾ of the site contained a new growth cedar forest. Historic aerial imagery from Google Earth indicates the forest was only about a decade old. Over the course of the field work for this project, the majority of the cedar forest was cleared by KDOT personnel. The southeast quarter of the site contained a 200-foot diameter mound of existing undocumented fill, about 13 feet higher in elevation than the surrounding area. Historic aerial imagery indicates the mound was placed around early 2016, and the site appears to have had minimal activity since. Prior to the placement of the fill mound, historic aerial imagery indicates the southeast quarter of the site was used sporadically for storage as a laydown area since at least 2008. The extent of former site grading and activities for the laydown area reached at least the locations of borings B-8 through B-10, B-13 through B-15, B-19 and B-20.

Prior to its use as a laydown area, historic aerial imagery indicates that the site contained the former route for I-70, as well as offramps to SE 21st Street and SE Rice Road. It is our understanding that this part of the interstate was demolished upon construction of the Oakland Expressway and subsequent I-70 relocation around 1998. The location of the former interstate corresponds with parts of the proposed lab, shop and administrative buildings, as well as the approximate locations of borings B-1, B-4, B-5, B-7, B-11, B-12, B-17 and B-18. After demolition and relocation of the interstate, the site appeared to have minimal activity and was a hay field prior to use as a laydown area. There were no existing buildings on the site at the time the fieldwork was performed. The existing ground surface sloped downward from south to north at a grade of about 3 to 4 percent.

The following presents a general summary of the major strata encountered during our subsurface exploration and includes a discussion of the results of field and laboratory tests conducted. Specific subsurface conditions encountered at the boring locations are presented on the individual boring logs in the Appendix of this report. Figure 2 in the Appendix shows a Generalized Subsurface Profile, based on the information obtained from the borings. The stratification lines shown on the boring logs and profile represent the approximate boundaries between soil and bedrock types; in-situ, the transition between materials may be more gradational in nature rather than clearly defined.

The borings encountered about 8 to 12 inches of dark brown topsoil at the surface. At borings B-7, B-8, B-10, B-11, B-13, B-15 B-18 and B-19, undocumented fill was encountered below the topsoil that continued to depths between 1.8 and 15 feet below existing ground levels. Borings B-10, B-13 and B-15 were drilled in the existing mound of undocumented fill on the southeast quarter of the site. Boring B-13 encountered undocumented fill that continued to the depth explored, 15 feet. The undocumented fill at this site was described as stiff to hard, lean clay (CL), silty lean clay (CL/ML), lean to fat clay (CL/CH), fat clay (CH), asphalt and loose limestone gravel (GP). Atterberg Limits performed on this material indicated Liquid Limits in the range of 38 to 58, with Plasticity Indices of 22 to 37. Laboratory tests on samples of the fill indicated moisture contents between 9.6 and 29.1 percent, dry densities between 94 and 113 pcf and unconfined and/or hand penetrometer strengths between 2,090 and 9,000 psf. Standard Penetration Tests performed in the undocumented fill yielded “N” values of 8 and 21 blows per foot. The fill was desiccated at boring B-7, B-8, B-11, B-15 and the upper 3 feet of fill at boring B-13.

Beneath the undocumented fill at borings B-8, B-10, B-11, B-15, B-18 and B-19, and beneath the topsoil at borings B-2 through B-6, B-9, B-12, B-14, B-16, B-17 and B-20, the borings encountered native soils described as medium stiff to hard fat clay (CH), lean to fat clay (CL/CH), lean clay (CL), and shaley fat clay (CH/SH) that continued to depths between 3 and 13 feet below existing ground level. Laboratory testing on samples of the native soils indicated moisture contents between 8.7 and 31.7 percent, dry densities between 89 and 106 pcf and unconfined or hand penetrometer strengths between 1,590 and 15,190 psf. Standard Penetration Tests performed in the native onsite soils yielded “N” values between 9 and 13 blows per foot. Atterberg Limits performed on the native onsite soils indicated Liquid Limits in the range of 55 to 76, with Plasticity Indices of 34

to 48. The native onsite soils were desiccated at boring B-3, B-11, B-12, B-16 and B-17, as well as the upper 3 feet at borings B-4 and B-6. The depth of desiccated soils at these locations vary from the upper 3 feet to the upper 8.6 feet.

The weathered tops of limestone and shale bedrock at this site were encountered at depths ranging from about 1 to 13 feet below current ground levels (Elevation 971.9 to 984.2 feet). The weathered bedrock at this site consisted of interbedded shale and limestone. The weathered shale varied in color from yellow to olive to gray brown to black. The weathered limestone at this site varied in color from yellow brown to tan. Auger refusal on what is thought to be hard limestone was encountered at depths ranging from about 6 to 13.6 feet below current ground levels (Elevation 966.9 to 981.0). The bedrock units that underlie this site are thought to be the Topeka Limestone Formation, which is part of the Pennsylvanian Age Shawnee Group. The Topeka Limestone Formation is comprised of alternating shale and limestone members.

GROUNDWATER OBSERVATIONS

Groundwater observations were made both during and after completion of drilling operations. All borings remained dry and no visible groundwater seepage was observed at the time the borings were performed. The materials encountered in the test borings have relatively low permeabilities and observations over an extended period of time through use of piezometers or cased borings would be required to better define current groundwater conditions.

Fluctuations of groundwater levels can occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our evaluation, it is our professional opinion that the proposed project site can be developed for the proposed buildings and pavement areas using conventional grading and foundation

construction techniques. We have recommended that the proposed lab building be supported on spread footings that are founded in the weathered shale and limestone bedrock units that underlie this site. We have recommended that the proposed shop and administrative buildings be supported on shallow spread footings that are founded in the stiff to very stiff clay soils on this site, controlled structural fill or on the weathered shale and/or limestone bedrock units that underlie this site. We have recommended that the proposed sheds be supported on shallow spread footings that are founded in the stiff to very stiff native clays on this site.

A major concern, from a geotechnical engineering standpoint, is the presence of expansive fat clays at this site. These soils have a high swell potential and could undergo significant volume change when soil moisture levels rise, resulting in differential heave of the floor slab. Another concern, from a geotechnical engineering standpoint, was the desiccated condition of naturally deposited fat clay soils that constitute the upper soils horizon at this site. The fat clays have high to very high shrink-swell potentials and can undergo significant volume change as the moisture contents of these soils vary with seasonal changes in precipitation, especially when these soils start out in a desiccated state. To reduce the potential for subgrade volume change and floor slab movement, we have recommended that a minimum of 24 inches of select, low volume change material be placed below the floor slabs for the lab, shop and administrative buildings and a minimum of 18 inches of select, low volume change material be placed below the floor slabs for the sheds. Depending on the finished floor elevations of the buildings, it may be necessary to undercut the proposed building areas to allow placement of the recommended select fill layer.

The other main geotechnical concern is related to the presence of undocumented fill at this site. The existing fill was apparently placed without any testing or supervision. Because of this, there is no way of knowing whether the fill was properly compacted and whether unsuitable materials have been incorporated in the fill section. The borings that were recently performed indicated that the fill was generally comprised of inorganic soils. In addition, the fill encountered did not appear to contain a significant amount of organic material, rubble or other unsuitable materials at the boring locations. However, the actual condition and suitability of the fill cannot be fully evaluated by borings performed after the fact. Borings can give an indication of the condition of the fill, but there is a risk that unsuitable or improperly compacted materials may have been incorporated in the fill section or were buried by the fill that was placed at the site. There is a risk that the fill may not provide suitable support for building foundations

and floor slabs. This risk cannot be eliminated without removing the existing fill and replacing it with controlled structural fill, or by supporting the proposed buildings on foundation elements that do not depend of the existing fill for their support.

Recommendations presented in the following sections outline procedures for site preparation and/or treatment of the onsite soils that are intended to produce structural fill sections and subgrades that are suitable for support of building foundations, floor slabs and pavements. These recommendations are based, in part, upon data obtained from our subsurface exploration. The nature and extent of subsurface variations that may exist at the proposed project site will not become evident until construction. If variations appear evident, then the recommendations presented in this report should be evaluated. In the event that any changes in the nature, design, location or depth of the proposed buildings are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and our recommendations modified in writing.

SITE PREPARATION

Site preparation should commence with stripping of all vegetation and topsoil from the areas of the proposed buildings and pavements. Based on the borings, an average stripping depth of approximately 8 to 12 inches would be anticipated for most areas. The stripping depths required will likely vary and should be adjusted to remove all vegetation and root systems. A representative of CFS Engineers should observe the stripping operations to evaluate that all unsuitable materials have been removed. Soils removed during site stripping operations could be used for final site grading outside the building and pavement areas. Care should be exercised to separate these materials to avoid incorporation of the organic matter in structural fill sections.

The tree removal has been completed on this site. Care should be taken to thoroughly remove all root systems from the proposed building areas. Materials disturbed during removal of stumps should be undercut and replaced with structural fill. A zone of desiccated soils may exist in the vicinity of the trees. The desiccated soils have a higher swell potential and should also be undercut and replaced with structural fill.

Relocation of any existing utility lines within the zone of influence of proposed construction areas should also be completed as part of the site preparation. The lines should be relocated to areas outside of the proposed construction. Excavations created during the removal of the existing lines should be cut wide enough to allow for use of heavy construction equipment to recompact the fill. In addition, the base of the excavations should be thoroughly evaluated by a geotechnical engineer or engineering technician prior to placement of fill. All fill should be placed in accordance with the recommendations presented in the Structural Fill section of this report.

Following site stripping, the proposed building areas should be undercut to stable natural soils and/or weathered bedrock. The undercut should extend a minimum of 10 feet beyond the proposed building lines, except for the sheds where the undercut should extend a minimum of 5 feet beyond proposed building lines. The purpose of the undercut is to remove the existing undocumented fill and replace it with controlled structural fill. Suitable, inorganic soils excavated during the undercutting process may be reused as structural fill, provided that this material is placed and compacted in accordance with the recommendations given in the Structural Sill section of this report. The undercut should be deep enough to allow for 24 inches of select, low volume change material and/or stabilized soil below the floor slabs and leveling courses for the lab, shop and administrative buildings and 18 inches of select, low volume change material below floor slabs and leveling courses for the sheds. The purpose of the select, low volume change fill section is to surcharge and to limit moisture changes in the underlying fat clay soils; thereby reducing the potential for volume changes resulting from moisture changes in these expansive clay soils. For the purposes of this report, low volume change materials are defined as soils having a Liquid Limit of 50 or less.

Following undercutting and prior to placement of structural fill, it is recommended that the exposed grade be scarified to a minimum depth of 8 inches and be moisture conditioned to bring the moisture content of the soils into the range recommended for structural fill. Moisture conditioning is the process of adjusting the moisture content of the scarified materials to a moisture content that is within a range of 0 to 4 percent above the optimum moisture content as determined by the Standard Proctor (ASTM D-698) compaction procedure. Following moisture conditioning, the scarified materials should be recompacted to a minimum of 95 percent of Standard Proctor (ASTM D-698) maximum dry density. Soft or unstable areas that hamper compaction of the subgrade

should be undercut and replaced with structural fill. Suitable structural fill should then be placed to design grades as soon as practical after reworking the subgrade to avoid moisture changes in the underlying soils.

Following moisture conditioning, it is recommended that the exposed grade be proofrolled. Proofrolling of the subgrade provides a more stable base for placement of structural fill and aids in identifying soft or disturbed areas. Unsuitable areas identified by the proofrolling operation should be undercut and replaced with structural fill. Proofrolling can be accomplished through use of a fully-loaded, tandem-axle dump truck or similar equipment providing an equivalent subgrade loading.

If soft or unstable conditions are encountered during the proofrolling operation, stabilization of the soils may be required. Clean crushed rock having a particle diameter of 3 to 6 inches could be used to stabilize the subgrade prior to placement of structural fill. After initial undercutting, the large rock would be spread over the unstable subgrade and worked into the soft soils by close tracking with a bulldozer or other suitable construction equipment. Additional rock would be added until the subgrade becomes firm enough to support construction equipment. The use of a geotextile fabric, in conjunction with crushed rock, could also be considered as a means of stabilizing the exposed grade.

Subgrade preparation for pavement areas will not need to be as extensive as recommended for the building areas. After the pavement areas have been stripped and cut to grade, the exposed subgrade soils should be thoroughly proofrolled. In fill areas, the grade exposed after site stripping of the topsoil should also be proofrolled in preparation for fill placement. Any soft or unstable areas observed during proofrolling should be undercut and brought up to planned grade with controlled structural fill.

CLIMATIC CONDITIONS

Weather conditions will influence the site preparation required. In spring and late fall, following periods of rainfall, the moisture content of the near surface soils may be significantly above the optimum moisture content. Perched ground water may also develop above impervious bedrock units (such as shale) saturating near surface materials. These conditions could seriously impede grading by causing an unstable subgrade condition. Typical

remedial measures include aerating the wet subgrade, removal of the wet materials and replacing them with dry materials or treating the wet material with Portland Cement.

If site grading commences during summer months, the moisture contents of the onsite clay soils may be abnormally low, which can significantly increase the swell potential of these materials. Typically, discing and moisture conditioning of the exposed subgrade materials to the moisture content criteria outlined in the Structural Fill section will reduce this swell potential of the dry materials. As an alternative, the dry materials could be undercut and replaced with structural fill.

EXCAVATIONS

Excavations will generally not be required at this site, except for foundations and utilities. It is anticipated that the foundation excavations will be in clay soils and/or weathered shale and limestone bedrock above the water table. The onsite clay soils and the soft, highly weathered shale with a Standard Penetration Resistance (N) value of less than 25 blows per foot can generally be excavated with conventional heavy equipment such as backhoes, loaders, etc. Excavations that extend into the underlying harder, less weathered shale or limestone bedrock units will be more difficult and will probably require the use of rock teeth, pneumatic breakers, or some other method of hard rock removal to complete the excavations.

Temporary construction slopes should be designed in strict compliance with the most recent governing regulations. The naturally deposited clay soils encountered in the borings would generally be classified as Type B soils, under Part 1926 of the OSHA regulations pertaining to open excavations. For these soils, it is recommended that temporary construction slopes be no steeper than 1(H) to 1(V). Construction slopes should be closely observed for signs of mass movement: tension cracks near the crest, bulging at the toe, etc. If potential stability problems are observed, the geotechnical engineer should be immediately contacted. The responsibility for excavation safety and stability of temporary construction slopes should lie solely with the contractor.

STRUCTURAL FILL

All structural fill should consist of approved materials, free of organic matter and debris. Fill placed within 24 inches of the lab, shop and administrative buildings floor slabs and leveling course gravel should consist of a lower plasticity cohesive soil having a Liquid Limit less than 50. The thickness of the select fill layer may be reduced to 18 inches below the floor slabs and leveling course gravel of the sheds. Higher plasticity soils could be used as structural fill in the lower portion of deep fill sections in the building areas and/or as structural fill in pavement areas where more movement can be tolerated. Fill should be placed in lifts having a maximum loose lift thickness of 9 inches. All fill should be compacted to a minimum of 95 percent of the material's maximum dry density as determined by ASTM D-698 (standard Proctor compaction). The moisture content of the fill at time of compaction should be within a range of 0 to 4 percent above optimum moisture content as defined by the standard Proctor compaction procedure. Moisture contents should be maintained within this range until completion of the building floor slabs.

Based on information obtained from the borings, there appears to be a limited quantity of onsite soil that will meet the criteria for the select, low volume change zone that has been recommended below the building floor slab. During the site preparation work, suitable low plasticity materials encountered during site grading work should be stockpiled. It is not known whether there is a sufficient volume of low volume change material available from onsite sources to complete the required select fill section.

We anticipate that the softer, more highly weathered shale, encountered within the upper portion of the shale bedrock profile, could be moisture conditioned and placed in a manner similar to a fat clay soil. Soft, highly weathered shale are defined as materials having similar physical characteristics to a fat clay soil, in that they can be easily molded and reshaped by hand. However, these materials should be evaluated by a representative of the geotechnical engineer prior to use as structural fill. We anticipate that significant amounts of water will have to be added to the weathered shale to increase moisture contents of these materials to levels necessary to achieve the required degree of compaction. Larger size fragments of limestone, excavated from the cut areas, should be placed outside planned structure and pavement areas, so that these materials do not hamper excavation of foundations and utilities.

In lieu of importing low plasticity material for use as low plasticity fill beneath the building floor slabs, the onsite fat clay soils could be stabilized with either hydrated lime or Portland Cement. The amount of lime and cement that is typically required to achieve the desired reduction in shrink-swell potential in on the order of 4 and 6 percent, respectively (dry weight basis). Laboratory tests will be necessary to determine the actual amount required. Recommendations and typical specifications for this method of stabilization could be provided if desired. Specifications for lime and/or cement stabilization should be included in the project specifications if these alternatives are to be implemented.

FOUNDATIONS

The types of foundation that would be suitable for support of the proposed buildings are dependent on the final location, configuration, and finished floor levels of the building, as well as the magnitude of the foundation loads, sensitivity to differential settlement, thickness of new fill required for site development and other factors. Because the proposed buildings are expected to have light to moderate foundation loads and the amount of site grading is expected to be relatively minor (i.e., cuts and fills on the order of 4 to 6 feet), we have recommended that the proposed buildings be founded on conventional spread footings that are founded in stiff, natural clay soils, weathered shale and/or in controlled structural fill.

Other types of foundations could be considered for support of the proposed buildings. Depending on the foundation loads and floor elevations, they may provide cost-effective alternatives and other benefits that the client may want to consider. An alternative foundation that we believe is appropriate would be Geopiers® (rammed aggregate piers). The use of rammed aggregate piers for support of the proposed buildings are discussed in a later section of this report.

SHALLOW SPREAD FOOTINGS

Because the proposed lab building is expected to have moderate foundation loads and there is as much as 10 feet of elevation difference across the building footprint, we have recommended that the proposed lab building be founded on conventional spread footings that are founded in the weathered shale and/or limestone bedrock

that underlies the proposed building site. Footings that are founded in the weathered shale and/or on weathered limestone bedrock may be proportioned for a maximum allowable bearing pressure of 3,500 psf. The allowable bearing pressure could be increased to 10,000 psf for footings founded on hard, gray shale and to 25,000 psf for footings that are founded on hard, unweathered limestone. The recommended bearing pressures include a safety factor of at least 3 against bearing failure.

Because the proposed shop and administrative buildings, as well as the sheds are expected to have light foundation loads and the site grading for these building areas is expected to be relatively minor, we have recommended that these buildings be founded on conventional spread footings that are founded in stiff, native clay soils, weathered shale or on controlled structural fill. Support of footings on or above any undocumented fill is not recommended and could result in adverse differential movement of the buildings. Spread footings that bear in the recommended bearing materials may be proportioned for a maximum allowable bearing pressure of 2,500 psf. The recommended bearing pressure include a safety factor of at least 3 against bearing failure.

Continuous footings should have a minimum width of 16 inches and isolated spread footings founded in native clay or controlled structural fill should have a minimum width of 30 inches. Rock bearing footings founded on limestone should have a minimum width of 24 inches and should be adequately reinforced to help bridge over joint cracks or other discontinuities that may occur in the bearing surface. All exterior footings and footings founded in the unheated portions of the structures should be supported a minimum of 3 feet below final exterior grade to provide protection against frost penetration. Where possible, footings should be earth-formed, i.e., poured to lines of neat excavation. The contractor should include a contingency to cover the cost of removing highly weathered and/or unsuitable rock.

Any uplift loads acting on the footings can be resisted by the effective dead weight of the footings plus the weight of the soil above the foundation element. For design purposes, soil backfill above the footings should be assumed to have a unit weight of 110 pcf.

Lateral loads acting on shallow footings resulting from short term dynamic loads, such as wind, may be resisted by the passive resistance of the native soils and by friction acting at the base of the foundation. The lateral load

capacity of the structure foundation can be determined using an allowable equivalent fluid unit weight of 280 pounds per cubic foot (pcf) for calculating the passive lateral earth pressure acting on the edge of footings. This allowable equivalent fluid pressure includes a factor of safety of about 1.5. The recommended passive pressure parameter is applicable for earth-formed foundations and should be determined from final grade to the bottom of the foundation; however, the passive resistance provided in the upper 3 feet of the profile should be ignored, as this is the zone subject to moisture changes and frost penetration. For sliding friction, an allowable friction coefficient of 0.28 could be assigned to the base of the foundation. The recommended sliding friction value includes a factor of safety of about 1.5.

The base of all footing excavations should be clean and dry and free of all water and loose materials, prior to placement of concrete. Concrete should be placed as soon as possible after excavating so that excessive drying of bearing materials does not occur. Should the soils at bearing level become excessively dry or wet, it is recommended that the affected material be removed prior to placement of concrete.

It is recommended that all footing excavations be observed and evaluated by a representative of the geotechnical engineer immediately prior to placement of foundation concrete. Unsuitable areas identified at this time should be corrected. Corrective procedures would be dependent upon conditions encountered and may include deepening of foundation elements, or undercutting of unsuitable materials and replacement with controlled structural fill.

Long-term structural settlement for shallow spread footings designed and constructed as outlined above should be minor; i.e., 1 inch or less. Differential structural settlement of up to ¾ inch should be anticipated across the building areas, since some footings will be founded on undisturbed soils and/or controlled structural fill, while other footings are founded in weathered bedrock.

GEOPIER FOUNDATION SYSTEM

Shallow foundation support bearing on a *Geopier*® reinforced subgrade (rammed aggregate piers) would be a viable option for this project and may potentially provide an economic benefit to this project. Based on our

experience with the *Geopier* soil reinforcement system, we anticipate that a *Geopier* reinforced subgrade could be designed to increase the net allowable soil bearing pressure at this site while limiting foundation settlement.

The *Geopier* soil reinforcement system consists of highly densified aggregate piers. The rammed aggregate pier elements are installed by drilling 30-inch diameter holes, and ramming thin lifts of well-graded aggregate within the holes to form very stiff, high-density aggregate piers. The drilled holes for this project should extend through the undocumented fill to the underlying bedrock. Following drilling of the Geopier hole, well graded aggregate is compacted in 12-inch loose lifts in the drill hole. Ramming takes place with a high-energy beveled tamper that both densifies the aggregate and forces the aggregate laterally into the sidewalls of the hole. This action increases the lateral stress in surrounding soils, thereby further stiffening the reinforced composite soil mass. The result of *Geopier* installation is a significant strengthening and stiffening of subsurface soils that then support floor slabs and high-capacity footings.

Geopier designs are based on a two-layer settlement analysis as described by Lawton et al. (1994) and in the *Geopier* Reference Manual. Settlements within the "upper zone" (zone of soil that is reinforced with *Geopier* elements) are computed using a weighted modulus method that accounts for the stiffness of the *Geopier* elements, the stiffness of the matrix soil, and the area coverage of *Geopier* elements below supported footings. Settlements within the "lower zone" (zone of soils beneath the upper zone which receives lower intensity footing stresses) are computed using conventional geotechnical settlement methods.

The *Geopier* soil reinforcement system is a proprietary design-build system and *Geopier*/Tensar should be contacted to provide engineering analyses and project specific design information for this project. The local contact in our area is Mr. Aaron Gaul, PE, with *Geopier*/Tensar at (816) 421-4334. *Geopier*/Tensar will provide information regarding the final system design, including the allowable foundation bearing pressure, *Geopier* shaft lengths and spacing, anticipated floor slab thickness, and a cost to support the proposed buildings.

If the *Geopier* system is selected, Quality Assurance testing should be performed during installation, including documentation of the soil conditions encountered, the shaft lengths, amount of aggregate used, verification of the modulus test readings, and tests on the compacted aggregate lifts. CFS Engineers would be pleased to provide this service.

SEISMIC HAZARDS DETERMINATION

Earthquake hazard evaluation is a complex task. Seismic sources must be identified and characterized, path effects evaluated (i.e., selection of appropriate attenuation relationships), and ground motions must be completed. In addition to the multi-discipline nature of this process, there is substantial parameter and modeling uncertainty associated with each of the steps. Typically, code-based approaches are used for seismic hazard analyses. Our seismic hazard evaluation follows the IBC 2021 procedures.

Seismic Soil Classification Table 1 presents the spectral acceleration parameters and accelerations from the United States Geological Survey (USGS) Design Maps website for this project location. From the USGS data in Table 1, the geotechnical conditions are best characterized by a "Class D" seismic design category according to the 2021 International Building Code.

Table 1 - Seismic Parameters

Seismic Parameters	Value
S_s	0.130g
S_1	0.068g
S_{MS}	0.170g
S_{M1}	0.150g
S_{DS}	0.120g
S_{D1}	0.098g

BUILDING FLOOR SLABS

The recommendations outlined in the Site Preparation and Structural Fill sections of this report are intended to produce subgrades that are suitable for support of building floor slabs. These recommendations include undercutting of the lab, shop and administrative building areas to allow placement of a minimum of 24 inches of select, low volume change material or stabilized soil below the floor slab and leveling course, and undercutting of the shed building areas to allow placement of a minimum of 18 inches of select, low volume change material below the slabs and leveling course. The select fill and/or stabilized soil layer below the floor slabs has been recommended to reduce the potential for subgrade volume change and floor slab movement. The recommended

low plasticity structural fill thickness is in addition to any granular section that will be required below the floor slabs. The moisture content of the subgrade soils should be maintained within the recommended range until floor slabs are completed. Depending upon weather conditions, periodic wetting may be required.

Immediately prior to construction of the building floor slab, it is recommended that the exposed subgrade be evaluated to determine whether moisture contents are within the recommended range and to identify areas disturbed by construction operations. Unsuitable or disturbed areas should be reworked prior to placement of the granular leveling course and construction of the floor slab.

Details regarding proper backfill of utility trenches and stem walls below building floor slab areas should be planned. Suitable low to moderate plasticity clays or granular material should be used as backfill materials. The backfill should be placed and compacted in accordance with the recommendations previously discussed.

Where possible, floor slabs should be designed and constructed as free slabs to allow for some differential movement between the walls, column points and floor slabs. It is recommended that a granular leveling course, having a minimum thickness of 4 inches, be used below normally loaded building floor slabs supported on soil subgrades. The granular section provides a capillary moisture break and acts as a leveling course. Clean crushed limestone gravel, with a nominal size of ½ to ¾ inch, would be recommended for the leveling course. A modulus of subgrade reaction of 100 pci may be used to design floor slabs constructed on an untreated clay subgrade.

In areas where floor loads are greater than 200 psf, it is recommended that a minimum of 12 inches of crushed limestone aggregate be placed below the building floor slab. The crushed rock may be substituted for a portion of the 24 inches of select, low volume change fill layer recommended for normally loaded floor slabs. The purpose of the crushed rock is to provide an improved subgrade for the more heavily loaded floor slab areas. In addition, the crushed rock will also provide a good working surface during construction. It is recommended that the crushed rock have a gradation similar to KDOT AB-3, except that the fines content (minus No. 200 material) should be less than 15 percent. The crushed rock should be placed in 6-inch lifts and compacted to a minimum of 95 percent of the material's maximum dry density as determined by ASTM D-698. The moisture content of

the crushed rock should be between plus and minus 3 percent of the optimum moisture content at the time of compaction. A modulus of subgrade reaction of 250 pci may be used to design floor slabs constructed on 12 inches of compacted crushed limestone aggregate.

Subsurface moisture and moisture vapor naturally migrate upward through the soil and, where the soil is covered by a building or pavement, this moisture will collect. To reduce the impact of this subsurface moisture and the potential impact of future induced moisture (such as landscape irrigation or precipitation), the current industry standard is to place a vapor retarder below the compacted crushed limestone layer. This membrane typically consists of visquene or polyvinyl plastic sheeting, having a thickness of at least 10 mils. It should be noted that although vapor barrier systems are currently the industry standard, this system may not be completely effective in preventing floor slab moisture problems. These systems typically will not necessarily assure that floor slab moisture transmission rates will meet floor covering manufacturer standards and that indoor humidity levels be appropriate to inhibit mold growth. The design and construction of such systems are totally dependent on the proposed use and design of the proposed building and all elements of building design and function should be considered in the slab-on-grade floor design. Building design and construction may have a greater role in perceived moisture problems since sealed buildings/rooms or inadequate ventilation may produce excessive moisture in a building and affect indoor air quality.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking or curling of the slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of the concrete. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) Manual.

The above procedures should reduce the potential for subgrade moisture variations and consequently reduce floor slab movement and cracking. However, these procedures will not completely eliminate the volume change characteristics of the natural clay soils and some long-term volume change may occur along with some floor slab movement and cracking. Isolation of floor slabs from walls and columns should be considered to

accommodate minor differential movement of floor slabs. If it is desired to further minimize the potential for subgrade volume change, the use of a greater thickness of low volume change material beneath the floor slab should be considered.

PAVEMENTS

Parking and drive area subgrades should be prepared in accordance with the recommendations given in the Site Preparation and Structural Fill sections of this report. Based on the soil types encountered at this site and previous experience with materials of this type, a design CBR value of 3 is recommended for design of pavement sections. For this design value, a full-depth asphaltic concrete section having a minimum thickness of 6 inches is recommended for automobile parking areas and 7 inches is recommended for the access drives. For asphaltic concrete pavements, a minimum surface course thickness of 2 inches is normally recommended. As an alternative to a flexible pavement section, the pavement areas could be paved with 6 inches of Portland Cement We normally recommend a 4-inch leveling and drainage course of clean, crushed rock be placed below all concrete pavements.

The pavement areas that will be used by heavy dump trucks may require thicker pavement sections. CFS Engineers would be pleased to provide specific thickness recommendations for heavy duty pavements, after we receive additional information regarding the type and number of trucks that are projected to use this facility over the design life of the pavement. Portland cement concrete pavements are recommended for approach slabs, dock aprons, truck drives and parking areas, trash dumpster pads and other areas where heavy wheel loads will be concentrated. It is recommended that the concrete pavements in these areas have a minimum thickness of 8 inches. We normally recommend a 4-inch leveling and drainage course of clean, crushed rock be placed below all concrete pavements.

We recommend that the pavement subgrades be evaluated by proofrolling immediately prior to paving. The moisture content and density of the top 8 inches of the subgrade should be checked within two days prior to commencement of actual paving operations. If the material is not in compliance with the required ranges of moisture or density, the subgrade should then be moisture conditioned and recompacted. If any significant

event, such as precipitation, occurs after the evaluation, the subgrade should be reviewed by qualified personnel immediately prior to placing the pavement. The subgrade should be in its finished form at the time of the final review.

Proper drainage below the pavement section helps prevent softening of the subgrade and has a significant impact on pavement performance and pavement life of all pavement types. Therefore, we recommend that a granular blanket drain be constructed at all storm sewer inlets within the pavement areas. The blanket drain should consist of clean, crushed stone aggregate extending a minimum of 6 inches below pavement subgrade level. The blanket drains should extend a minimum of 15 feet away from the curb at all storm sewer inlets, and should be a minimum of 15 feet wide. The grade within the blanket drain should be sloped toward the storm sewer inlet, and weep holes should be drilled through the inlet to provide drainage of the granular section into the inlet. Placement of geotextile filter fabric across the weep holes could be considered to prevent loss of aggregate through the weep holes.

Proper drainage is a key to the long-term performance of any pavement section. It is recommended that all pavements be properly sloped to provide rapid runoff of surface water. Water should not be allowed to pond on or adjacent to pavements, since this could result in saturation of the subgrade and cause premature deterioration of pavements. Pavements in Kansas are normally subjected to 30 or more freeze-thaw cycles in any given year. Because of this, periodic maintenance of all of the pavements is essential to long term performance and should be anticipated. This should include sealing of all cracks and joints and by maintaining proper surface drainage next to paved areas.

PLANS AND SPECIFICATIONS REVIEW

It is recommended that the geotechnical engineer be provided the opportunity to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical engineering recommendations in the design and specifications. In the event that CFS Engineers is not given the opportunity to perform this recommended review, we will assume no responsibility for misinterpretation of our geotechnical engineering recommendations.

CONSTRUCTION OBSERVATION AND TESTING

To effectively achieve the intent of the geotechnical recommendations presented in this report and to maintain continuity from design through construction, CFS Engineers should be retained to provide observation and testing services during earthwork and foundation construction phases of the project. This will provide the geotechnical engineer with the opportunity to observe the subsurface conditions encountered during construction, evaluate the applicability of the geotechnical recommendations presented in our report as they relate to the soil and bedrock conditions encountered, and to provide follow up recommendations if conditions differ from those described in our report.

LIMITATIONS

The analysis and recommendations submitted in this report are based in part upon the subsurface information obtained from the borings performed at the indicated locations and our present knowledge of the proposed construction as outlined in the Project Description. Subsurface conditions may vary between the boring locations and across the site and our report does not reflect any variations which may occur. The nature and extent of such variations may not become evident until construction. If subsurface conditions are encountered during construction that differ from those described in this report, CFS Engineers should be notified immediately so that a review may be made and any supplemental recommendations provided. If the scope of the proposed construction, including the proposed loads, floor slab elevations or locations, changes from that described in this report, our recommendations should also be reviewed and the recommendations modified accordingly.

This report has been prepared in accordance with the generally accepted geotechnical engineering practice as it exists in the area at the time of our study. No warranty is expressed or implied. The recommendations provided in this report are based on the assumption that an adequate program of observation and testing will be conducted during the construction phase in order to evaluate compliance with our recommendations. Our scope of services did not include any environmental assessment or exploration for the presence of hazardous or toxic materials in the soil, surface water, groundwater or air, on, below or around this site.

This report has been prepared for the exclusive use of our client for specific application to the project discussed. Any party other than the client who wishes to use this report shall notify CFS Engineers in writing of such intended use. Additional work may be required before an updated report can be issued. Non-compliance with any of these requirements will release CFS Engineers from any liability resulting from the use of this report by any unauthorized party and client agrees to defend, indemnify and hold harmless CFS Engineers from any claim or liability associated with such unauthorized or non-compliance.

APPENDIX

Boring Location Sketch

Figure 1

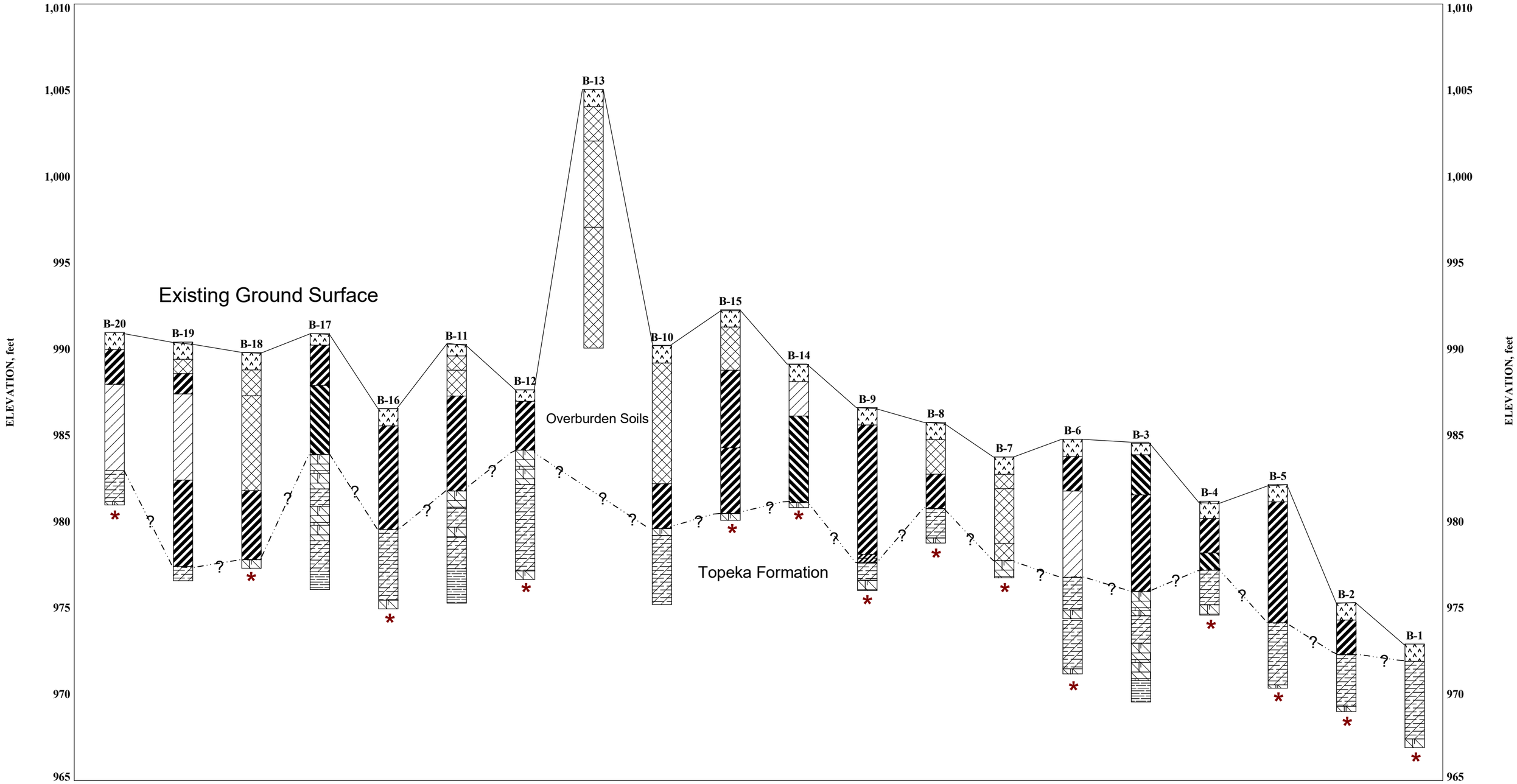
KDOT District 1 Office and Lab Buildings

S ½ SE ¼ SW ¼ of Section 3, T12S, R16E

Topeka, Kansas

Approved By: JJZ	Project No. 23-5162

CFS ENGINEERS



GENERALIZED SUBSURFACE PROFILE

FIGURE 2

KDOT District 1 Office and Lab Buildings
S ½ SE ¼ SW ¼ of Section 3, T12S, R16E
Topeka, KS

Approved By: JJZ

Project No.: 23-5162

* = Auger Refusal

LEGEND

- Topsoil
- Fill
- Shaley Fat Clay
- Fat Clay
- Lean Clay
- Lean to Fat Clay
- Weathered Shale
- Shale
- Weathered Limestone

CFS ENGINEERS
cfse.com

BOREHOLE INFORMATION **Page 1 of 1**

STATION OFFSET

NORTHING **575,177.4** EASTING **11,393,416.3**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-1

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Surface Elevation:	**972.9**
	FA								1.0	**Topsoil**, dark brown (12")	971.9
1	ST	22		*3500	111	16.0				**SHALE, weathered, soft, olive gray, trace limestone fragments	
2	ST	21		*5500	107	21.9			5		
	FA								5.5		967.4
									6.0	**LIMESTONE, highly weathered	966.9

AUGER REFUSAL @ 6 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**7-26-23**		
Boring Completed	**7-26-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**TP/NG**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION **Page 1 of 1**

STATION OFFSET

NORTHING **575,166.1** EASTING **11,393,696.1**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-2

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG
	FA							
1	ST	24		5500	96	23.8	CH	
2	ST	22		3560	102	22.8		
	FA							

** compressive strength in psi * Calibrated Penetrometer

DEPTH, Feet.

MATERIAL DESCRIPTION

Surface Elevation: 975.3

1.0 **Topsoil**, dark brown (12") 974.3

3.0 **FAT CLAY**, very stiff, olive brown to brown to dark brown, with iron nodules and stains, with roots, trace fine gravel 972.3

5

6.0 **SHALE, weathered, soft, olive gray, with roots 969.3

6.3 **LIMESTONE, hard, gray brown 969.0

AUGER REFUSAL @ 6.3 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

ATTERBERG LIMITS

Sample ST-1, Depth 1-3 feet

LL	PL	PI
73	28	45

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**7-28-23**		
Boring Completed	**7-28-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **575,011.0** EASTING **11,393,210.3**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-3

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL
	FA						
1	ST	23		10980	100	15.3	CL CH
2	ST	24				17.1	CH
	FA						
3	SS	6	69/8"			8.2	
	FA						
4	SS FA	0	50/½"				

** compressive strength in psi * Calibrated Penetrometer

MATERIAL DESCRIPTION

Surface Elevation: 984.6

DEPTH, Feet.		
0.7	**Topsoil**, dark brown (8")	983.9
3.0	**LEAN TO FAT CLAY**, hard, desiccated, gray and brown, with iron nodules and stains, trace fine gravel	981.6
5	**FAT CLAY**, very stiff, brown, with iron stains	
8.6		976.0
10.0	**LIMESTONE**, highly weathered, tan to yellowish brown	974.6
10	**SHALE**, weathered, soft to mod. hard, olive tan to gray brown	
11.6		973.0
13.7	**LIMESTONE**, highly weathered, seamy, tan to yellowish brown	970.9
15.0	**SHALE**, hard, gray	969.6
15	**BOTTOM OF BORING**	

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**8-15-23**		
Boring Completed	**8-15-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION **Page 1 of 1**

STATION OFFSET

NORTHING **575,005.1** EASTING **11,393,602.4**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-4

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Surface Elevation:	**981.2**
	FA								1.0	**Topsoil**, dark brown (12")	980.2
1	ST	24		2610	95	17.9	CH		3.0	**FAT CLAY**, stiff, brown to dark brown, with roots	978.2
2	ST	12		3220	96	18.8	CL CH		4.0	**LEAN TO FAT CLAY**, stiff, olive yellow brown	977.2
	FA								5	**SHALE, weathered, soft to mod. hard, olive	
									6.0		975.2
									6.6	**LIMESTONE, hard, gray brown	974.6

AUGER REFUSAL @ 6.6 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**8-1-23**		
Boring Completed	**8-1-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,995.4** EASTING **11,393,815.8**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-5

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
										Surface Elevation: 982.2
	FA								1.0	**Topsoil**, dark brown (12") 981.2
1	ST	22		5650	101	22.0	CH			**FAT CLAY**, very stiff, dark brown to brown, with roots, trace coarse sand and fine gravel
2	ST	19		4110	99	26.2	CH		5	
	FA								8.0	974.2
3	ST	22		*4500	105	23.6				**SHALE, weathered, soft, olive to gray
	FA								10	
									11.6	970.6
									11.8	**LIMESTONE, hard, gray brown 970.4
										AUGER REFUSAL @ 11.8 feet
										**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**7-28-23**		
Boring Completed	**7-28-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,903.1** EASTING **11,392,991.8**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-6

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL
	FA						
1	ST	17		15190	106	16.1	CH
2	ST	13		*4000	104	17.0	CL
	FA						
3	ST	6		4460	97	25.4	
4	SS	9	20			23.7	
	FA						

** compressive strength in psi * Calibrated Penetrometer

MATERIAL DESCRIPTION

Surface Elevation: 984.8

DEPTH, Feet.		
1.0	**Topsoil**, dark brown (12")	983.8
3.0	**FAT CLAY**, hard, brown, with roots, trace coarse sand, desiccated	981.8
5	**LEAN CLAY**, stiff to very stiff, light brownish gray, with iron stains and nodules, desiccated	
8.0		976.8
10	**SHALE, weathered, soft to mod. hard, brown to yellow and gray to olive, with 6" gray weathered limestone seam between 9.9 to 10.4 ft	
13.3		971.5
13.6	**LIMESTONE, hard, gray brown	971.2

AUGER REFUSAL @ 13.6 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

ATTERBERG LIMITS

Sample ST-1, Depth 1-3 feet

LL	PL	PI
57	21	35

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**8-1-23**		
Boring Completed	**8-1-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION **Page 1 of 1**

STATION OFFSET

NORTHING **574,896.4** EASTING **11,393,412.6**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-7

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Surface Elevation:	**983.8**
	FA								1.0	**Topsoil**, dark brown (12")	982.8
1	ST	7		7310	110	13.9	CL		2.0	**FILL**, lean clay, red brown, with gravel	981.8
	FA								5	**FILL**, fine to coarse limestone gravel	
									5.0		978.8
									6.0	**FILL**, lean to fat clay, stiff, brown	977.8
									7.0	**LIMESTONE**, hard, gray brown	976.8

AUGER REFUSAL @ 7 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**7-26-23**		
Boring Completed	**7-26-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**TP/NG**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,906.1** EASTING **11,393,599.2**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-8

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG
	FA							
1	ST	14		5840	101	16.1	CH	
2	ST	16		3720	97	26.0	CH	
	FA							

** compressive strength in psi * Calibrated Penetrometer

DEPTH, Feet. 5

MATERIAL DESCRIPTION

Surface Elevation: 985.8

1.0 **Topsoil**, dark brown (12") 984.8

3.0 **FILL**, fat clay, very stiff, brown, trace fine rocks and iron stains, desiccated 982.8

5.0 **FAT CLAY**, stiff, brown and gray, with iron nodules and stains 980.8

6.7 **SHALE, weathered, soft, olive 979.1

7.0 **LIMESTONE, hard, gray brown 978.8

AUGER REFUSAL @ 7 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

ATTERBERG LIMITS

Sample ST-2, Depth 3-5 feet

LL	PL	PI
76	28	48

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	8-1-23		
Boring Completed	8-1-23	Field Engineer	SH
Drill Rig	Diedrich D-50	Driller / Helper	JW/CM
Approved By:	JJZ	Project No.	23-5162

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,881.0** EASTING **11,393,812.6**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-9

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Surface Elevation:	**986.6**
	FA								1.0	**Topsoil**, dark brown (12")	985.6
1	ST	17		5240	97	26.8	CH			**FAT CLAY**, very stiff, brown to dark brown to gray brown, with roots, iron stains and iron nodules, with silt-sized pockets of reddish yellow highly weathered limestone below 8 feet	
2	ST	16		5860	102	22.6	CH		5		
	FA										
3	ST	12		*3000	97	26.8	CH		8.5		978.1
	FA								10.0	**SHALE, highly weathered, soft, olive yellow and gray	976.6
									10	10.6 **LIMESTONE, hard, gray brown	976.0

AUGER REFUSAL @ 10.6 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

ATTERBERG LIMITS

Sample ST-1, Depth 1-3 feet

LL	PL	PI
63	24	38

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**7-28-23**		
Boring Completed	**7-28-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,865.6** EASTING **11,393,709.4**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-10

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL
	FA						
1	ST	10		*9000	102	11.1	CL CH
	FA						
2	ST	14		6380	113	18.4	CL CH
	FA						
3	ST	21		1590	93	28.5	CH
	FA						
4	SS	10	80/10"			13.0	
	FA						

** compressive strength in psi * Calibrated Penetrometer

DEPTH, Feet.

MATERIAL DESCRIPTION

Surface Elevation: 990.2

Topsoil, dark brown (12") — 1.0 — 989.2

FILL, lean to fat clay, very stiff to hard, desiccated, brown to dark brown, with roots and concrete, trace limestone gravel and roots, desiccated down to about 3 feet

8.0 — 982.2

FAT CLAY, medium stiff, brown and gray, mixed, with iron nodules

10.6 — 979.6

11.0 — **LIMESTONE**, highly weathered — 979.2

SHALE, weathered, soft to mod. hard, olive

15.0 — 975.2

BOTTOM OF BORING

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

ATTERBERG LIMITS

Sample ST-3, Depth 8-10 feet

LL	PL	PI
74	27	47

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	8-1-23		
Boring Completed	8-1-23	Field Engineer	SH
Drill Rig	Diedrich D-50	Driller / Helper	JW/CM
Approved By:	JJZ	Project No.	23-5162

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,777.1** EASTING **11,393,194.5**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-11

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL
	FA						CL CH
1	ST	6					
	FA						
2	SS	7	13			8.7	CH
	FA						
3	ST	6				13.3	CH
4	SS	13	71			15.9	
	FA						
5	SS	1	61/7"			21.8	
	FA						

** compressive strength in psi * Calibrated Penetrometer

MATERIAL DESCRIPTION

Surface Elevation: 990.3

DEPTH, Feet.		
0.7	**Topsoil**, dark brown (8")	989.6
1.5	**FILL**, lean to fat clay, reddish brown	988.8
3.0	**FILL**, asphalt	987.3
5	**FAT CLAY**, stiff, brown to dark brown	
8.5		981.8
9.5	**LIMESTONE**, weathered, yellowish brown	980.8
10.6	**SHALE**, weathered, soft, olive tan to brown	979.7
11.2	**LIMESTONE**, weathered, yellowish brown	979.1
13.0	**SHALE**, weathered, mod. hard, olive tan to brown	977.3
15.0	**SHALE**, hard, black, carbonaceous	975.3

BOTTOM OF BORING

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**8-15-23**		
Boring Completed	**8-15-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,765.7** EASTING **11,393,401.8**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-12

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Surface Elevation:	**987.7**
	FA								0.7	**Topsoil**, dark brown (8")	987.0
1	ST	19		*9000		19.8	CH			**FAT CLAY**, hard, dark brown, with roots	
2	SS	1	50/1"			4.4			3.5		984.2
	FA								5	**LIMESTONE, highly weathered, seamy, yellow brown to tan	
									5.5		982.2
										**SHALE, weathered, soft to mod. hard, brown to olive brown to tan	
3	SS	15	14			24.1			10		
	FA								10.5		977.2
									11.0	**LIMESTONE, hard, yellow brown	976.7

AUGER REFUSAL @ 11 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**8-15-23**		
Boring Completed	**8-15-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,760.1** EASTING **11,393,597.7**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-13

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Surface Elevation:	**1005.1**
	FA								1.0	**Topsoil**, dark brown (12")	1004.1
1	ST	19		6740	113	15.0	CL		3.0	**FILL**, lean clay, very stiff, dark brown, with roots and limestone gravel, desiccated	1002.1
2	ST	20		2380	106	22.1	CL		5	**FILL**, lean clay, stiff, brown to dark brown, with silt, trace limestone gravel	
	FA								8.0		997.1
3	ST	8		2090	94	29.1	CL ML		10	**FILL**, silty lean clay, stiff, dark brown to gray to tan, trace gravel	
	FA										
4	ST	11		2250	99	26.7	CL ML		15.0		990.1
									15	**BOTTOM OF BORING**	

ATTERBERG LIMITS
Sample ST-1, Depth 1-3 feet

LL	PL	PI
38	17	22

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

Dry W.D.

Dry A.B.

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**8-1-23**		
Boring Completed	**8-1-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,765.4** EASTING **11,393,807.5**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-14

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
										Surface Elevation: 989.1
	FA									**Topsoil**, dark brown (12")
									1.0	988.1
1	ST	24		3490	99	18.4	CL			**LEAN CLAY**, stiff, brownish gray, with silt
									3.0	986.1
2	ST	15		4230	104	19.3	CL CH			**LEAN TO FAT CLAY**, very stiff, grayish brown, with iron stains, trace fine roots
									5	
	FA									
									8.0	981.1
3	SS	0	50/0"						8.3	**LIMESTONE**, hard, gray brown 980.8

AUGER REFUSAL @ 8.3 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**7-28-23**		
Boring Completed	**7-28-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,733.9** EASTING **11,393,711.5**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-15

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	DEPTH, Feet.	MATERIAL DESCRIPTION	
									Surface Elevation:	**992.3**
	FA							1.0	**Topsoil**, dark brown (12")	991.3
1	SS	6	21			9.6	CL CH		**FILL**, lean to fat clay, very stiff, desiccated, brown, with gravel	
	FA							3.5		988.8
2	SS	9	9			27.4	CH		**FAT CLAY**, stiff, gray, with iron stains, trace fine roots	
	FA							5		
								8.0		984.3
3	ST	22		3790	101	24.0	CH		**FAT CLAY**, stiff, brown to gray brown, with iron nodules and stains	
	FA							10		
								11.8		980.5
								12.2	****LIMESTONE**, hard, gray brown	980.1

AUGER REFUSAL @ 12.2 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**7-28-23**		
Boring Completed	**7-28-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,696.3** EASTING **11,392,998.7**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-16

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Surface Elevation:	**986.6**
	FA								1.0	**Topsoil**, dark brown (12")	985.6
1	ST	24		10830	98	15.1	CH			**FAT CLAY**, hard, light grayish brown to red brown, with iron nodules and stains, trace gravel, desiccated	
2	ST	21		*9000	104	17.6	CH		5		
	FA								7.0		979.6
										**SHALE, weathered, soft, brown to olive	
3	SS	14	23			21.8			10		
	FA								11.1		975.5
									11.6	**LIMESTONE, hard, gray brown	975.0

AUGER REFUSAL @ 11.6 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

ATTERBERG LIMITS

Sample ST-1, Depth 1-3 feet

LL	PL	PI
55	21	34

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**8-1-23**		
Boring Completed	**8-1-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION **Page 1 of 1**

STATION OFFSET

NORTHING **574,697.9** EASTING **11,393,194.7**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-17

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL
	FA						
1	SS	3	12			16.9	CH
2	ST	19		7800	98	12.8	CL CH
3	ST	24		4930	97	16.0	CL CH
4	ST	13		*9000	110	11.4	
	FA						
5	SS	16	62/10"			22.9	

** compressive strength in psi * Calibrated Penetrometer

MATERIAL DESCRIPTION

Surface Elevation: 990.9

DEPTH, Feet.		
0.7	**Topsoil**, dark brown (8")	990.2
	FAT CLAY, stiff, dark brown	
3.0		987.9
	LEAN TO FAT CLAY, very stiff, desiccated, light grayish brown, with fine roots	
7.0		983.9
	LIMESTONE, highly weathered, seamy, yellow brown to tan	
9.0		981.9
	SHALE, weathered, mod. hard, gray brown	
10.0		980.9
	LIMESTONE, weathered, seamy yellow brown to tan	
12.0		978.9
	SHALE, weathered, mod. hard, olive tan to gray brown	
13.8		977.1
	SHALE, hard, black, carbonaceous	
14.8		976.1

BOTTOM OF BORING

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**8-15-23**		
Boring Completed	**8-15-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,691.7** EASTING **11,393,397.1**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-18

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
										Surface Elevation: 989.8
	FA								1.0	**Topsoil**, dark brown (12") 988.8
1	ST	12		3960	103	21.0	CH			**FILL**, fat clay, stiff, brown to dark brown to yellow, with fine limestone gravel and roots
	FA								2.5	987.3
2	SS	10	8			17.1	GP			**FILL**, weathered limestone gravel, loose, yellow, coarse, with clay
	FA								5	
									8.0	981.8
3	ST	18		*3500	91	31.7	CH			**FAT CLAY**, stiff, brown to reddish brown to gray to yellow, mixed, with roots
	FA								10	
									12.0	977.8
									12.5	**LIMESTONE**, hard, gray brown 977.3

AUGER REFUSAL @ 12.5 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

ATTERBERG LIMITS

Sample ST-1, Depth 1-2 feet

LL	PL	PI
58	21	37

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**7-26-23**		
Boring Completed	**7-26-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**TP/NG**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,692.9** EASTING **11,393,604.3**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-19

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Surface Elevation:	**990.4**
	FA								1.0	**Topsoil**, dark brown (12")	989.4
1	ST	22		*6000	89	28.4	CL CH		2.0	**FILL**, lean to fat clay, red brown, with gravel	988.4
									3.0	**FAT CLAY**, very stiff, dark brown, with roots	987.4
2	ST	16		*5500	99	23.9	CL			**LEAN CLAY**, very stiff, light gray, with silt, iron nodules and stains	
	FA								5		
									8.0		982.4
3	ST	8		2330	92	31.0	CH			**FAT CLAY**, stiff, brown to grayish brown, with iron nodules and stains	
	FA								10		
									13.0		977.4
4	ST	10		3770	106	20.6			13.8	**SHALE**, weathered, soft, olive yellow	976.6
										BOTTOM OF BORING	
										**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.	

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

CFS ENGINEERS

Boring Started	**7-26-23**		
Boring Completed	**7-26-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**TP/NG**
Approved By:	**JJZ**	Project No.	**23-5162**

BOREHOLE INFORMATION Page 1 of 1

STATION OFFSET

NORTHING **574,688.3** EASTING **11,393,805.9**

DRILLING COMPANY **CFS Engineers**

METHOD **4-inch Flight Augers** HAMMER **Auto**

LOG OF BORING NO. B-20

PROJECT NAME **KDOT District 1 Office and Lab Buildings**

SITE LOCATION **S ½ SE ¼ SW ¼ of Section 3, T12S, R16E Topeka, Kansas**

OWNER | ENGINEER **KDOT | CFS Engineers**

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
										Surface Elevation: 991.0
	FA								1.0	**Topsoil**, dark brown (12") 990.0
1	ST	11		4760	95	26.0	CH		3.0	**FAT CLAY**, very stiff, dark brown, with roots and iron stains 988.0
2	ST	14		5420	104	23.0	CL		5	**LEAN CLAY**, very stiff, light gray to brownish gray, with silt, with iron nodules and stains
	FA								8.0	983.0
3	ST	22		2170	103	26.9			9.8	**SHALE, highly weathered, soft to mod. hard, yellow to olive 981.2
	FA								10 10.0	**LIMESTONE, hard, gray brown 981.0

AUGER REFUSAL @ 10 feet

**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

ATTERBERG LIMITS

Sample ST-1, Depth 1-3 feet

LL	PL	PI
69	27	42

** compressive strength in psi * Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be more gradational in nature.

WATER LEVEL OBSERVATIONS

▽ **Dry W.D.**

▼ **Dry A.B.**

Backfilled @ Completion

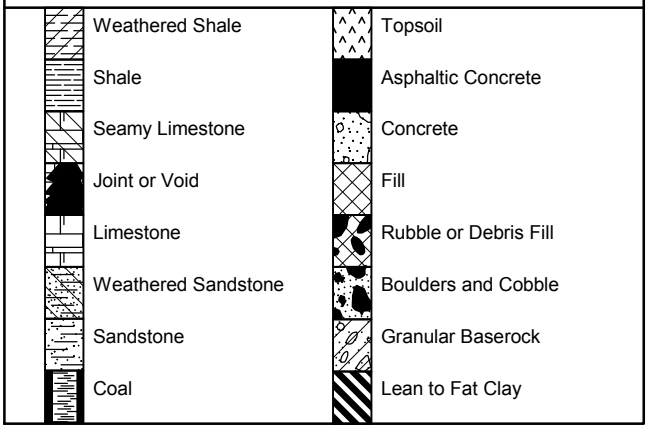
CFS ENGINEERS

Boring Started	**7-28-23**		
Boring Completed	**7-28-23**	Field Engineer	**SH**
Drill Rig	**Diedrich D-50**	Driller / Helper	**JW/CM**
Approved By:	**JJZ**	Project No.	**23-5162**

UNIFIED SOIL CLASSIFICATION (ASTM D-2487-98)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	Cu>4 AND 1<Cc<3	GW	WELL-GRADED GRAVEL
			Cu>4 AND 1>Cc>3	GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND
			Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS<"A" LINE	ML	SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY
			PI PLOTS <"A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT

BEDROCK AND OTHER MATERIAL SYMBOLS



BEDROCK PROPERTIES & DESCRIPTIONS

ROCK QUALITY DESIGNATION

DESCRIPTION	RQD (%)
Very Poor	0 - 25
Poor	25 - 50
Fair	50 - 75
Good	75 - 90
Excellent	90 -100

BEDDING CHARACTERISTICS

TERM	THICKNESS (inches)
Massive	> 60
Very Thick Bedded	36 - 60
Thick Bedded	12 - 36
Medium Bedded	4 - 12
Thin Bedded	1 - 4
Very Thin Bedded	0.4 - 1
Laminated	< 0.4

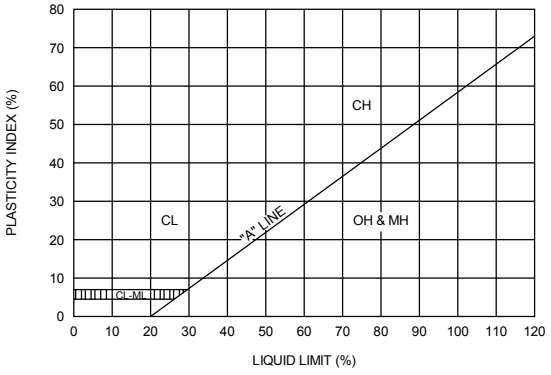
DEGREE OF WEATHERING

Slightly Weathered - Slight decomposition of Parent material in joints and seams.
Weathered - Well-developed and decomposed joints and seams.
Highly Weathered - Rock highly decomposed, may be extreemly broken.

BEDROCK DISCONTINUITIES

Bedding Planes	Planes dividing the individual layers, beds or strata of rocks.
Joints	Fractures in rock, generally more or less vertical to the bedding.
Seams	Applies to bedding planes with an unspecified degree of weathering.

PLASTICITY CHART



PENETRATION RESISTANCE
(RECORDED AS BLOWS / 0.5 FT)

SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.50
MEDIUM DENSE	10 - 30	MEDIUM STIFF	4 - 8	0.50 - 1.0
DENSE	30 - 50	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	VERY STIFF	15 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

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General Notes and Terms

BORING LOG SYMBOLS

SURFACE MATERIALS


TOPSOIL


FILL MATERIAL


ASPHALTIC CONCRETE


CONCRETE


GRANULAR BASE

COHESIVE SOILS


SILT


CLAYEY SILT


LEAN CLAY


LEAN TO FAT CLAY


FAT CLAY

LARGE GRANULAR SOILS


COBBLES & BOULDERS


WELL GRADED GRAVEL


POORLY GRADED GRAVEL


SILTY GRAVEL


CLAYEY GRAVEL

GRANULAR SOILS


SANDY SILT


SILTY SAND


FINE SAND


POORLY GRADED SAND


WELL GRADED SAND


GRAVELLY SAND

BEDROCK UNITS


SHALE


FISSILE SHALE


SANDSTONE


LIMESTONE


COAL

WEATHERED BEDROCK


JOINT OR VOID


WEATHERED SHALE


WEATHERED SANDSTONE


WEATHERED LIMESTONE

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Key to Soil Symbols and Terms

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE-GRAINED SOILS (major portions retained on No. 200 sieve): includes (1) clean gravel and sands and (2) silty or clayey gravels and sands. Condition is rated according to relative density as determined by laboratory tests or standard penetration resistance tests.

Descriptive Terms	Relative Density	SPT Blow Count
Very loose	0 to 15 %	< 4
Loose	15 to 35 %	4 to 10
Medium dense	35 to 65 %	10 to 30
Dense	65 to 85 %	30 to 50
Very dense	85 to 100 %	> 50

FINE-GRAINED SOILS (major portions passing on No. 200 sieve): includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings, SPT blow count, or unconfined compression tests.

Descriptive Terms	Unconfined Compressive Strength kPa	SPT Blow Count
Very soft	< 25	< 2
Soft	25 to 50	2 to 4
Medium stiff	50 to 100	4 to 8
Stiff	100 to 200	8 to 15
Very stiff	200 to 400	15 to 30
Hard	> 400	> 30

GENERAL NOTES

1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.

2. Descriptions on the boring logs apply only at the specific boring locations and at the time the borings were made. They are not guaranteed to be representative of subsurface conditions at other locations or times.

WATER LEVEL OBSERVATIONS

Water level shown on the boring logs were measured at the times indicated, In sands and other granular soils, the indicated levels may reflect the location of groundwater. In clays and other low permeability soils, the accurate determination of the level of the groundwater is not possible with only short-term observations.

WATER LEVEL OBSERVATION DESIGNATION

W.D. - While Drilling A.B. - After Boring

B.C.R. - Before Casing Removal A.C.R - After Casing Removal

24 hr. - Water Level takes at approximately 24 hours after boring completion

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravel (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravel with fines (Appreciable amount of fines)	GM* d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			GC	Clayey gravels, gravel-sand-silt mixtures	Atterberg limits above "A" line or P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM* d / u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clays (Liquid limit less than 60)		ML	Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and Clays (Liquid limit greater than 60)		MH	Inorganic silts, micaceous or disto-maceous fine sandy or silty soils, organic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
	Highly Organic Soils		Pt	Peat and other highly organic soils	

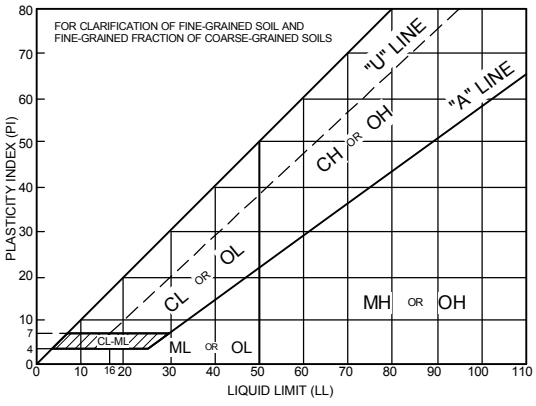
Determine percentages of sand and gravel from grain size curve, Depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows:

Less than 5 percent..... GW, GP, SW, SP
More than 12 percent..... GM, GC, SM, SC
6 to 12 percent..... Borderline case4s requiring dual symbols**

Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

Particle Size	Sieve sizes	mm
Material	Silt or clay	< 0.074
	Sand	0.074 to 0.42
	Fine	0.42 to 2.00
	Medium	2.00 to 4.76
	Coarse	#200 to #40
		#40 to #10
		#10 to #4



Plasticity Chart

Particle Size	Sieve	mm
Material	Gravel	
	Fine	#4 to 3/4 in. 4.76 to 19.1
	Coarse	3/4 in. to 3 in. 19.1 to 76.2
	Cobble	3 in. to 12 in. 76.2 to 304.8
	Boulders	12 in. to 36 in. 304.8 to 914.4

* Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg Limits: suffix d used when L.L. is 23 or less and the P.I. is 6 or less; the suffix is used when L.L. is greater than 26.

** Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.