Traffic Signals (update 2021)

1. Get roadway plans
	1. Get Khris template for design
		* Check if design has funding left in project manager toolbox (on intranet)
			1. Go to Highway project info center
			2. Go to SYP project info
			3. Enter item number
			4. Pick D phase and check if any funding is left. If not we do not need to get template.
		* Send email to Keri Ross for template number. Use PNS2006 to get funding code required.

Ex. 6-415.00

Fund: 12fo

Department: 625

Unit: 3300

Location: 06

Activity: 4260

Function: fd52

sub function: 008

program: 8842201d

* 1. Talk to project manager
* Get contact for Roadway Designer (may be consultant) and Utility Coordinator
* Get contact for Electrical service (usually from utility coordinator)
	+ Find what quadrant the power is will be supplied from
	+ If overhead (Max. distance that your pole can be from overhead service for drop)
	+ If underground (requirements for underground –meter, conduit, where service is coming from). May have special requirements from the electric company.
	+ Get minimum distances (Horizontal /vertical) that steel strain poles can be locate near overhead/underground electric
	1. Plans can usually be found in ProjectWise under Documents/Projects/district or from the roadway consultant (but don’t count on them being the most up-to-date unless the project manager says so)
* Individual roadway plan sheets for each intersection in Microstation format (.dgn)
* Propose DTM(or cross sections) and ALG
* Existing DTM if needed
* Proposed utilities plans (dgn or pdf)
* Proposed Striping (dgn)
	1. If ORD type files
* Get ORD files with DTM with them.
* Get all references if they are any.
* References may have to be re-referenced so that they show up.
1. Make new folder in ProjectWise under Documents/Central Office/Traffic Operations/Branch-Design Services/District/ Signals
	1. Name folder Item Number + road name(main and cross)+year as main folder
	2. Make secondary folder - Originals
* All original roadway plan sheets
* ALL original striping plan sheets
	1. Make secondary folder – Originals (if ORD)
		+ All original roadway plan sheets in ORD
		+ References (may have to re-map them)
	2. Make secondary folder - Working Folder
* Copy roadway plan sheets
* ALL SIGNAL STANDARDS.dgn (under design resources/signals and lighting standard detail sheets/signals)
	1. Make secondary folder - Working Folder (if ORD)
* Copy roadway plan sheets in ORD (re-map references)
* All signal standards 2d test.dgn (under design resources/signals and lighting standard detail sheets/ord final)
	1. Make secondary folder - Estimates
* (current year) Signal and Lighting Estimate.xls (under design resources/construction cost estimates)
* Project install items (current date).xls (under design resources/ construction cost estimates)
* Signal Quantities Estimator(under design resources)
* Project release of warehouse material form (current year)- under design resources/construction cost estimates
	1. Make secondary folder - Documents
* Documents from website for SALSA
* Conduit sizing.xls (under design resources)
	1. Make secondary folder – Inroads (not needed for ORD)
* Proposed DTM(cross sections) and alg
* Existing DTM
	1. Make secondary folder - Utilities plans (May be needed if not dgn format)
* Proposed utilities
1. Get checklist from Traffic Engineering group for each intersection (don’t start design until you get the checklists or approval).-You may have to start before the checklist is done but it should not be the norm. Make sure the checklist is for the new design not the existing.
2. Setup field visit for each intersection with the district traffic engineering and utilities company if signal is existing/new or the road is existing but being widened
* Determine steel strain pole and signal pedestal locations before the field visit
* Send Steel strain pole and pedestal locations to utility coordinator to verify any conflict with overhead or underground utilities. May need to give approximate heights of steel strain poles.
* If road is new construction contact electric company to locate which quadrant that the electric will be coming from.
1. Design steps
* Open design file under projectwise in microstation (Always)
	+ If ORD right click and use open with and choice Open Roads (ORD), may need make it default on the file.
* Pick traffic design workflow under Tasks when you open microstation
	+ In ORD, in box in upper right choice KYTC ribbon and you will see the different ribbons along the top, ours are split in Traffic Signals and Traffic Lighting(you have to have ord cad standards installed to see them)
* Reference in striping and utilities in microstation. Have signal check list available.
* (Only use in select 4 not ORD) In microstation, clean up copied design plan (you can delete all items not needed or can turn off layers not needed) and merge in striping plan (can be copy and pasted in file). Do not delete roadway needed for GES loops. You may want to do a save as before you start deleting things so that you can go back and add anything back if deleted by accident.
* ORD setup:
	+ Open ord on desktop
	+ Assign a workspace (this is in upper middle)- choice KYTC\_Standards\_WSP.
	+ Create a workset- (this is in upper middle next to workspace)- hit create workset
		- In name: use item number (this will become your workset folder name on the c drive)
		- In description: you can leave blank or main road name
		- In template pick \_WorkSet\_Template
		- Do note the location of the workset, it will be in the c drive KYTC\_CADD\_Standards\workspaces\KYTC\_Standards\_WSP\Worksets
* To change workset properties for use on plan sheets go to Properties on right hand side of ORD and click the down arrow and go to advanced properties
	+ Under edit workset modify property (these will be use in the plan sheet and will automatically fill in on sheet)
* Now browse and open original file from Projectwise in working folder. Make sure that the workset is the one that you just setup. To check go to file and close- you should see workset in top middle or open explorer from search ribbon on top right.
* Reference in All signal standards 2d test.dgn
	+ Fit view and zoom in to the reference
	+ Use element selection to select on standards and then copy and move around it
	+ Detach reference All signal standards 2d test.dgn
	+ Rotate view (2 points) along the line on the standards
	+ Go to explorer and fix sheet index- open explorer from search ribbon
		- Go to sheet index tab
		- Hit pencil icon to edit and click on folder
		- Hit manage sheet index button
		- Change sheet prefix to T, change increment to 1, change start number to 1: do on each tab the same
* Go to ribbon tab Drawing Production- select named boundary
	+ Choice civil plan- should be first symbol at top left
	+ Drawing seed- plan sheet and detail scale should be full size 1=1
	+ You will start with the left hand standard which is quantity sheet. In name: type Signal Quantity Sheet
	+ Description: copy name into this
	+ Check create drawing and show dialog
	+ Hit arrow next to start location - bottom left should say identify path element and select line in center of each standard- move vertical line to first end of the provide box click for the start and move vertical line to almost the end of the original box and accept for the end point- you should only get one box. If you got more then one you were to close to the end point and it create two (make sure you redo before you get to the next step.
	+ Create drawing box will come up- fix name in name box
	+ Check that A scale is right for the drawing model and the sheet model (full size 1=1)
	+ Check add to sheet index and open model
	+ Hit ok- this should make a design model and a sheet model for this standard
	+ If you want to modify the standard drawings, you will need to do it in the default model not the design or the sheet model of that standard.
	+ Open explorer and you should see under the sheet index tab your new sheet
	+ Repeat (go back to default model to do this) for other standard and design plan sheet (use alignment in design to do plansheet - need to figure out what scale that you want on the design side, usually 20 for signals). Remember where ever the box lays is what you get in you design and sheet models. Also make sure that you turn off any layers or references that you do not want in the design/sheet before you do the named boundary. **DO NOT DELETE ITEM, USE OFF BY ELEMENT BY RIGHT CLICKING ON LEVEL DISPLAY.**
* In microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet), locate steel strain poles (need to be inside R/W, outside clearzone (reference roadway design guide table 3-1), should have four poles in box configuration as base design). Use the button pallet under Tasks to get Cells (Steel Poles).
	+ For Clearzone, you will need the ADT of the road. You can get that from the planning website (KYTC Traffic Counts under Maps).
	+ If poles are near overhead utilities, the pole location shall be far enough away from utility pole/lines per the rules from the utility company. (Typical horizontal/vertical 10’ from transmission and 5’ for secondary).
	+ If poles (base 3’ in diameter and can be up to 21’ in the ground) are near underground utilities, the pole location shall be far enough away from the utility per the rules from the utility company.
	+ If this distance cannot be done, you may have to consider not placing a pole on that corner or may have to consider a mast arm installation(if mast arm pole see 5a for design)
	+ Place poles near sidewalk if possible. If there is enough right a way to place outside the clearzone all poles need to be placed outside clearzone.
	+ Verify all locations with the utility coordinator
	+ If not enough right a way and pole needs to be placed in sidewalk, make sure that pole base (3’ diameter) only takes no more than 2’ of the sidewalk. If ped buttons are installed on the pole, the button placement cannot exceed 10” horizontal from the paved surface.
* In microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet), locate signal pedestal poles (need to be inside R/W, Can be in the clear zone because they are on breakaway bases, may be one for every pedestrian crossing point). Use the button pallet under Tasks to get Cells (Steel Poles).
	+ Place pedestal near the crosswalk ramp, may need multiple ones on corner if the pedestrian ramp is split.
	+ If pedestal poles (base 2’ in diameter and shall be 4’ in the ground) are near underground utilities, the pole location shall be far enough away from the utility per the rules from the utility company. Typical underground utilities are 4’ to 6’ in the ground.
	+ Place poles near or in sidewalk. If ped buttons are installed on the pole, the button placement cannot exceed 10” horizontal from the paved surface or crosswalk.
	+ Verify all locations with the utility coordinator
	+ Pedestal poles can have a maximum of two signal heads and two buttons.
* In microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet), locate pedestrian signals and pedestrian buttons. They can be placed on Steel Stain poles or Signal Pedestals. Use the button pallet under Tasks to get Cells (Ped signal).
	+ - Place Pedestrian heads on side of pole that will get it farthest away from traffic but within the 20 degree cone of the crosswalk.
		- Place pedestrian buttons/sign so that it is in line with the crosswalk. Remember that the sign has an arrow on it and it needs to be installed so that it is in the right direction. Typically the button is installed below the sign.
* In microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet): If base mounted cabinet, locate so that the pole on that quadrant will protect the base mounted cabinet. Use base mounted on all locations except for locations that do not have room for the base mounted cabinet. If overhead service, see detail. If underground service, the meter and disconnect should be placed on pole or on a separate structure. You may want to note that the underground service structure will be built into the proposed base mounted concrete base (78” By 36”). Use the button pallet under Tasks to get Cells (Cabinets).
* In microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet): if pole mounted cabinet, locate cabinet on pole nearest the service drop. If overhead service, see detail. If underground service, the meter and disconnect should be placed on pole or on a separate structure. Use the button pallet under Tasks to get Cells (Cabinets).
* If service meter and disconnect is not located in the same quadrant or over 50’ cabinet, a secondary disconnect shall be noted to be placed on the pole or on the separate structure built-in to the cabinet base. Note that this will be incidental to the installation of the cabinet. There may be a special note or standard for this.
* In microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet): Add messenger wire between each poles and place signal heads/signs (identify what each is –ex. 3-section/4-section or sign LXW) for each phase as specified by the checklist. Make sure that signal heads are between 40’ to 180’ from the stop-bars on all approaches. Use the button pallet under Tasks to get Cells (Signal Head).
	+ If messenger crosses over or under utility lines, the attachment of the messenger should be placed to follow the rules set by the utility company.
	+ If this distance cannot be done, you may have to consider not placing a pole on that corner or may have to consider a mast arm installation.
	+ All through movements typically will have two 3-section (ball) signals per approach (there should be one head per each through lane). The signal heads will be placed in the middle of each lane. If there is one through lane, the two heads shall be placed 2’ in from each lane line if 12’ lane (8’ minimum spacing). If the left turn movement is old style permitted with 5-section, the first through lane head usually is placed on the adjacent right through lane line.
	+ All left turn movements typically will have one 3-section (protected) or one 3 (ra-ya-ya)/4-section(ra-ya-ya-ga) protected/permitted per lane. If old style permitted movement with 5-section head, the head will be placed on the right hand lane line.
	+ All right turn movements typically do not get a signal head placement.
	+ If a right overlap, the signal head will typically be a 5-section head and be placed in the left hand lane line but be more than 8’ from any other head.
	+ If a split phase approach, the typical signal head arrangement will be a 4-section (gb-yb-gb-ga) in left most lane and a 3-section in the right most lane. Each head will be centered in the lane.
	+ If there are signs, place the signs as specified by the district traffic engineer or the central office traffic engineer. Place signs so that they are at least 1’ from an adjacent signal head or other sign (note the width of the sign or signal head).
* Open inroads (under applications to the right of File, pick inroads group then activate inroads). If ORD, you will need to go to default or design model to get the elevations. Get elevations for pole locations and furthest signal head (to use in SALSA) on each span from proposed DTM or use existing if proposed dtm does not have an elevation in that location.
	+ Under inroads box, open dtm and alg under file, ORD instructions below:
		- Reference your design model into your default model to see work in the design model to do elevations.
		- For ORD, go to Survey ribbon, choice Terrain tab, choice label terrain spots- make sure the terrain dgn is reference in the default model and make sure the that all levels are activated on that dgn (go to level display)
		- When toolbox appears set test style to KYTC-Proposed .120
		- Bottom left hand description will ask you to identity terrain model- the terrain model is the line that surrounds the triangles seen on the screen.
		- If you choice the terrain model, it will go to select spot on bottom left and you should see an elevation as you move through the terrain model area.
		- Pick you spot and accept it and the tool will place a value. Do remember that this only shows on this default not on you design or sheet models
	+ Geometry tab hit plus sign for newly added alignment and pick right roadway (right click and set active). The right alignment should track on the center of the road. To see this open tracking, under tools- box will pop-up and hit activate.
	+ Surfaces tab set active to right elevation file. Use tracking to verify. You may have to use existing to get elevation.
* Measure length of each span (in ORD go to **design model** to do, if you cannot find go to search ribbon and type measure and you can pick the tool)
	+ If drop span measure the full length using each drop span and the original span between the drops. This will be used in SALSA.
* Measure the lengths between poles and signal heads on each span- measurement should be from original pole to each items hanging on the span. (in ORD go to design model to do, if you cannot find go to search ribbon and type measure and you can pick the tool)
* Measure angles between poles and messenger wire- usu ally two span per pole. (in ORD go to design model to do, if you cannot find go to search ribbon and type measure and you can pick the tool)
	+ If drop span, the measurement for each item is from the pole with drop included. See instructions in SALSA for this.
* Open salsa website (salsatraffic.com)
	+ Pick the configuration that you are using for the signal and follow the online instruction.
		- If you want to copy an old salsa run, go to old salsa file and hit copy job link in old salsa file. The copy will show up in my design folder.
	+ Fill in the info for your design in setup and generate salsa file.
		- make sure that file name for the salsa configuration includes the district (d#), county, main street, cross street
		- Code version should be the latest version of AASHTO. This is defaulted to the current one.
		- Change department if you want others in your group folder to be able to see it and modify. Otherwise keep it in my designs folder and you will be the only one that can modify
	+ Go to link on right to layout
		- Enter Lengths, angles (will show if you have angles not added up to the proper angle max.) and hit save button. It should show info in the dynamic design layout.
		- If drop span measure the full length using each drop span and the original span between the drops.
	+ Go to Link on right for Attachment Height Calc (this will help you pick your pole height and attachment of each span)
		- Add pole ground elevation for each pole location
		- Add pedestal height for each pole location (see pic below to explain this)
		- Add ground elevation under controlling element. (Typically the furthest head in the middle of the span. It also could be the longest head)
		- Pick the attachment depth for the controlling head.
			* If it’s the left turn head but the head is just a 3-section head, need to change to 4-section head for future installation of the flashing yellow.
			* If controlling head is the permitted 5-section head, add a 4-section in the middle of the left and add 3-section in the through lanes which should make it a 4-3-3 span configuration instead of a 5-3 configuration.
			* Sag % should always be 5% in this Calculator. This is because we typical use 5 % on the plan sheet.
			* Hit Save button and scroll down you will see the calculated results and an export excel file. The program will have suggestions for recommended pole heights and attachment heights on later input locations.
	+ Go to link on right for pole inputs.
		- Click on each pole under Pole box. A suggestion should be displayed below that box if the attach height calc was completed. It will show minimum and maximum pole ranges.
		- In dropdown box beside the pole box pick the pole type you want for each pole. Make sure that you hit the save button after each choice.
		- After you choice all of your pole heights, attachments & Options will be shown below the pole selection. This input area is for only attachments on the steel strain pole
			* Hit plus sign for Pole attachments (all these items will be centered in the middle of the attachment)
				+ Arm align- see picture to the right for oriented angle
			* Hit plus sign for Luminaire arm or mast arm.
				+ Arm list- all these items will be centered in the middle of the attachment
				+ Arm align- see picture to the right for oriented angle
				+ Attachment List- all these items will be at actual attachment height.
	+ Go to link on right for wire span inputs
		- In segment box pick each span and you can input the sag and attachments heights to each pole for the span attachment picked. When you pick the span, recommended attachments heights will be shown for each pole attachment.
			* Input sag should be 3% except for a drop span. This will be the default. We recommend that this stays 3% for future add-ons heads/signs to the span. We also want to add at least two 36”x36” sign between the heads for future.
			* Input attachment height for each attachment on the span picked.
			* Hit save button after each sag and attachment has been entered for each span. Note it will give an error if you choose an attachment in the same place on the same pole. They need to be at least 0.5’ apart on the pole.
			* Hit plus sign for each span to add the signals and signs to the span. The distance for each head/sign will be from the first pole in the span highlighted in the segment box. Example AB span starts from pole A. Please note if the span approach has a left turn lane on it you need to add the 4-section flashing yellow for this even if it is not noted on the checklist. This will be a 4-3-3 configuration instead of the 5-3 configuration.
			* Note that signal heads and signs shall be positioned so that they do not overlap. (Width of typical 3-section with back plate is 24” and 5-section with back plate is 38”).
			* Distance should be to the center of each attachment item.
			* You can add/update the attachment and it will show up in the wire attachments box in the order from distance from the first pole. Make sure that you hit add button or it will not add the attachment. If you want to update an existing attachment, pick it in the box and change it and hit update button.
	+ Go to link for Analysis. The analysis will run automatically. There will be 3 pdfs that show up after the analysis finishes. If there are errors, all errors will show up at the top of the page.
		- Download and add the 3 analysis pdfs to the documents folder in projectwise.
* In Microstation (not use in ORD, see section about named boundaries), place cell sheet SP from the KTYCsheet.cel library for border (on top bar element/cells). All design and notes shall be in this border. The scale is 20 usually. If all notes/etc can’t fit on this scale please add another plan sheet. (Do Not move/change orientation of drawing)
* In Microstation (in ORD, go to KYTC ribbon/Traffic Signals), place loops (6x30 quad pole) and GES loops (6x6) at distance specified by the checklist. Use the button pallet under Tasks to get Cells (Loops).
	+ Placed loop cell behind the stopbar and leave enough room to show loop slot cut to the junction box. The front side of the GES loops should be at the distance specified on the check list. Add loop wire line to conduit at side of road.
	+ There will be conduit from loop slot to the junction box on edge of road. It will be a foot into the shoulder or roadway or in curve. This will be 1” RS conduit and needs to be Bid.
	+ Right turn lanes shall have loop placed on Side Street only.
	+ Note splice locations in the quadrant notes. This will be the splice of the loop wire to the loop lead-in.
	+ If video/radar is used, all camera/radar locations should be noted in the quadrant notes. You may want to use the loop cell without line in middle to denote detection zone locations. There will be cameras placed on poles so that it is to the right side of the interior lane it is facing at. The radar shall be placed according to manufacturer’s recommendations (may need two antennas on an approach with GES and stop-bar loops). All antennas and camera locations should be noted in the quadrant notes.
	+ If Sensys detection, a circle (phase #) should be place in each for the installation of each in pavement detection device. There will be 3 circles (pucks) per stopbar loops and 1 circle (puck) per GES loops. All antenna locations should be noted in the quadrant notes. The main antennas should be placed on the closest pole near the cabinet.
* Place conduits and junction boxes for loops (in ORD, go to KYTC ribbon/Traffic Signals), . Use the button pallet under Tasks to get Cells (Conduit).
	+ Place junction boxes (Type B) at the right side of each loop in the road. The junction box can be used for more than one loop. If there is an entrance in the run of the GES conduit, typically we add a junction box on each side of the entrance (paved). This conduit shall be a minimum of 2”
	+ Typical conduits size shall be 1 ¼” except when it is under the roadway and it shall be 2”.
	+ Use conduit sizing.xls for conduit sizing. (Under design resources). This should be used to verify that a 1 ¼” conduit is correct.
	+ Junction boxes shall be parallel with the road or curve it is near.
	+ The junction boxes shall be placed in utilities strip or behind the sidewalk or near edge of the shoulder if right-a-way is available. Do not place junction boxes in drainage areas.
	+ Typical GES approaches will have 1 left turn loop, 2 near loops, and 2 back loops, the conduit from the pole to the left turn junction and to the near loops is 2” and beyond that will be 1 ¼”
* Place all traffic note and legends cells from traffic workflow task bar (in ORD, go to KYTC ribbon/Traffic Signals).
	+ Quadrant notes (1 for each quadrant)
	+ Loop schedule
	+ Wiring schedule
	+ Signal legend (need to drop to change but regroup after revised)
	+ North arrow
	+ Signal heads legend (need to drop to change but regroup after revised)
	+ Flashing yellow note
	+ Pole schedule or school schedule. Get pole heights, attachment heights, and moments form Salsa thin report.
	+ Messenger wire/quad pole note. Get messenger size from the Salsa thin report.
	+ Clamp assembly note. Needed if attachment is below 2 foot of the height of any pole.
	+ Breakline cell for GES loops. You will use two per break.
	+ Add direction arrows for all lanes approaching the intersection.
	+ For any other notes use the 20 scale note button and use the leader button. All notes and lines shall be on cadd standard level.
* Modify notes and legends
	+ All quadrants that have items installed on them should have a quadrant notes. See typical notes in traffic workflow task bar.
	+ Add stations for all poles (except pedestal) in quadrant notes
	+ Add phase # to all signal and pedestrian heads and loops. Each junction box shall be numbered.
	+ Note any conduit that is different from the typical conduit on legend.
	+ Scale all poles, cabinet, pedestals, junction boxes so that they can be read on a 20 scale. May have to print out on 11x17 to see if scale is enough.
* Leave street names for all approaches. May have to rotate.
* Enter a description into the bottom right of the SP sheet: EX. Signal plan for (Main) @ (Cross) (In ORD, open properties of the plan sheet model (use search ribbon to find), under general/description add sheet name, to delete STA To/Scale:, double click on cell on sheet and delete)
* Enter County, Item number, Sheet number in top right of SP sheet (in ORD, go to plan sheet model, all these fields are under the workset advanced properties and can be located if you go to file and close the dgn, this will on the right hand side under properties) .
* Enter cadd standard sheet name in bottom left of SP sheet. Do not drop the sheet because esheets will not work. (In ord this is not needed)
* In Ord, do remove unwanted levels use Off By Element in the level display. You will have to do this on the design model and the plan sheet model.

5A. Mast Arm pole design

* In microstation(if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet), locate mast arm poles (need to be inside R/W, outside clearzone (reference roadway design guide table 3-1), typically you will have two mast arm poles with two arms. Use the button pallet under Tasks to get Cells.
	+ If poles are near overhead utilities, the pole location shall be far enough away from utility pole/lines per the rules from the utility company. (Typical horizontal/vertical 10’ from transmission and 5’ for secondary).
	+ If poles (base 3’ in diameter and can be up to 16’ in the ground) are near underground utilities, the pole location shall be far enough away from the utility per the rules from the utility company.
	+ If this distance cannot be done, you may have to consider not placing a pole on that corner or may have to consider another corner.
	+ Place poles near sidewalk if possible but if right a way to place outside the clearzone all poles need to be placed outside clearzone.
	+ If not enough right a way and pole needs to be placed in sidewalk, make sure that pole base (3’ diameter) takes no more than 2’ of the sidewalk. If ped buttons are installed on the pole, the button placement cannot exceed 10” horizontal from the paved surface.
	+ Mast arm poles should be placed so that the arm will be on the far side not near side of the approach.
	+ Verify all locations with the utility coordinator
	+ You need to consider the length of the arm so that the arm does not block the signal heads of another arm located of any other corner for any other approaches.
	+ The vertical pole diameter should be 20” typically.
	+ The arm diameter cannot be more 20” per specifications. This would be at the pole attachment and would be ¼” taper to the end of the arm
	+ Make sure that signal heads are between 40’ to 180’ from the stop-bars on all approaches.
	+ Place signal heads/signs (identify what each is –ex. 3-section/4-section or sign LXW) for each phase as specified by the checklist.
	+ Get elevations for poles locations and furthest signal head on each span from proposed DTM or use existing if proposed dtm does not have an elevation in that location. See above location of Inroads Application. This will be use for the attachment height of each arm. ORD instructions below:
		- Reference your design model into your default model to see work in the design model to do elevations. You can now do this in the design model.
		- For ORD, go to Survey ribbon, choice Terrain tab, choice label terrain spots- make sure the terrain dgn is reference in the default or design model and make sure the that all levels are activated on that dgn (go to level display)
		- When toolbox appears set test style to KYTC-Proposed .120
		- Bottom left hand description will ask you to identity terrain model- the terrain model is the line that surrounds the triangles seen on the screen.
		- If you choice the terrain model, it will go to select spot on bottom left and you should see an elevation as you move through the terrain model area.
		- Pick you spot and accept it and the tool will place a value. Do remember that this only shows on this default not on you design or sheet models
* Attachment height of mast arm (Salsa Calculator is in the future updates)
	+ Should usually at the same attachment height (if not at same height, you need to consider the attachments plates for each arm). Need to check this attachment for each arm. The attachment plate can be around 2’ square.
	+ Should be on a 90 degree angle. If other angles the arms need to be at different attachments.
	+ Each mast arm shall have a 3 degree rise. This note will have to be added to the plan sheet.
	+ Attachment should include the 6” rise of the base for when not being installed in sidewalk and be 0” when installed in the sidewalk.
	+ Also need to consider about 6” for the how much the pole base plate will be above the top of the base.
	+ Check that each signal head is between 17’ to 19’ from the elevation of the road (arm is at 3 degree rise). This will be look at for each arm if dual.
	+ Use signal head lengths, should come directly from SALSA (this will include backplates and hangers when using these lengths). This is find under design assumptions/attachments in salsa design file.
	+ Signal heads shall be placed in the center of the length from SALSA. The length can be moved about the 1” each way if needed for 3-section and 1 ½” for 4-section. The signal also can hang below arm but not desirable. The state typically does not have this hanger assembly.
* In microstation, locate signal pedestal poles (need to be inside R/W, Can be in the clear zone because they are on breakaway base, may be one for every pedestrian crossing point). Use the button pallet under Tasks to get Cells.
	+ Place pedestal near the crosswalk ramp and may need multiple ones on corner if the pedestrian ramp is split.
	+ If pedestal poles (base 2’ in diameter and shall be 4’ in the ground) are near underground utilities, the pole location shall be far enough away from the utility per the rules from the utility company. Typical underground utilities are 4’ to 6’ in the ground.
	+ Place poles near or in sidewalk. If ped buttons are installed on the pole, the button placement cannot exceed 10” horizontal from the paved surface or crosswalk.
	+ Verify all locations with the utility coordinator
	+ Pedestal poles can have a maximum of two signal heads and two buttons.
* In microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet), located pedestrian signals and pedestrian buttons. They can be placed on Steel Stain poles or Signal Pedestals. Use the button pallet under Tasks to get Cells.
	+ - Place Pedestrian heads on side of pole that will get it farthest away from traffic but within the 20 degree cone of the crosswalk.
		- Place pedestrian buttons/sign so that it is in line with the crosswalk. Remember that the sign has an arrow on it and it needs to be install so that it is in the right direction. Typically the button is installed below the sign.
* In microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet): If base mounted cabinet, locate it so that the pole on that quadrant will protect the base mounted cabinet. Use base mounted on all locations except for locations that do not have room for the base mounted cabinet. If overhead service, see detail. If underground service, the meter and disconnect should be placed on pole or on a separate structure. You may want to note that the underground service structure will be built into the proposed base mounted concrete base (78” By 36”). Use the button pallet under Tasks to get Cells.
* In microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet): if pole mounted cabinet locate cabinet on pole nearest to the service drop. If overhead service, see detail. If underground service, the meter and disconnect should be place on pole or on a separate structure. Use the button pallet under Tasks to get Cells.
* If service meter and disconnect is not located in the same quadrant or over 50 feet from cabinet, a secondary disconnect shall be noted to be placed on the pole or on the separate structure built-in to the cabinet base. Note that this will be incidental to the installation of the cabinet. There may be a special note or standard for this.
* Open salsa website (salsatraffic.com)
	+ Pick the mast arm configuration and follow the online instruction.
		- If you want to copy an old salsa run, go to old salsa file and hit copy job link in old salsa file. The copy will show up in my design folder.
	+ Fill in the info for your design in setup and generate salsa file.
		- make sure that file name for the salsa configuration includes the district (d#), county, main street, cross street
		- Code version should be the latest version of AASHTO. This is defaulted to the current one.
		- Change department if you want others in your group folder to be able to see it and modify. Otherwise keep it in my designs folder and you will be the only one that can modify
	+ Go to link on right to pole inputs
	+ Enter pole height (will show if you have angles not added up to the proper angle max.) and hit save button. It should show info in the dynamic design layout. Pick materials if do not want steel. Pole height will be at least 2’ above the highest attachment of the mast arm.
		- After you choose your pole height, attachments & Options will be shown below the pole selection. This input area is only for attachments on the mast arm pole arms.
			* Hit plus sign for Pole attachments (all these items will be centered in the middle of the attachment)
				+ Arm align- see picture to the right for oriented angle
			* Hit plus sign for Luminaire arm and mast arm.
				+ Arm list- all these items will be centered in the middle of the attachment. If more than one arm is placed, arms should be at same height, or at least 24” apart if not at 90 degrees.
				+ Arm align- see picture to the right for oriented angle. The arm should be 90 degrees from other arm. If arm at different angle, the arms should be at different heights and be at least 24” apart on the attachments.
				+ Highlight arm to add Attachments in attachment list- all these items will be at actual attachment height. All items measured from face of pole (typical 20”). Do not consider 3 degree rise on this. You will have to highlight other arm if more than one to add attachment to it.
				+ You can add/update the attachment and it will show up in the attachments list in the order from distance from the face of the mast arm pole for the arm highlighted. Make sure that you hit add button or it will not add the attachment. If you want to update an existing attachment, pick it in the box and change it and hit update button.
				+ Please note if the mast arm approach has a left turn lane on it you need to add the 4-section flashing yellow for this even if it is not noted on the checklist. This will be a 4-3-3 configuration instead of the 5-3 configuration.
				+ Note that signal heads and signs shall be positioned so that they do not overlap. (Width of typical 3 section with back plate is 24” and 5-section with back plates is 38”).
				+ Distance should be to the center of each attachment item.
	+ Go to link for Analysis. The analysis will run automatically. There will be three pdfs that show up after the analysis finishes. If there are errors, all errors will show up at the top of the page.
		- Download and add three analysis pdfs to the documents folder in projectwise.
* In Microstation (not done in ORD), place cell sheet SP from the KTYCsheet.cel library for border (on top bar element/cells). All design and notes shall be in this border. The scale is 20 usually. If all notes/etc can’t fit on this scale please add another plan sheet.
* Make mast arm chart: (Typical chart is available)
	+ Includes arm length (s), attachment (s), X/Y orientation,
	+ Type of signal or sign attachment,
	+ Distance of each signal head and sign from the face of the pole.
	+ Weight of each signal head and sign. (See SALSA)
	+ Should include length, width, and deep of each signal heads and signs
	+ Pedestrian head, pole mounted cabinet, beacon cabinet, and signs on pole.
	+ Note moment for pole base. From salsa “thin” report.
	+ Pole height will be at least 2’ above the highest attachment of the mast arm.
	+ Each arm should have future signals and signs.
		- Street sign at 5’ off pole typical (remember this is the center of the sign so may be different if sign is longer)
		- Lane signs (should be one on end of arm and one beside each signal head)
		- Possible flashing yellow head.
* In Microstation (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet), place loops (6x30 quad pole) and GES loops (6x6) at distance specified by the checklist. Use the button pallet under Tasks to get Cells.
	+ Placed loop cell behind the stopbar and leave enough room to show loop slot cut to the junction box. The front side of the GES loops should be at the distance specify on the check list. Add loop wire line to conduit at side of road.
	+ There will be conduit from loop slot to the junction box on edge of road. It will be 1’ into the shoulder or roadway or in curve.
	+ Right turn lanes shall have loop placed on Side Street only.
	+ Note splice locations in the quadrant notes. This will be the splice of the loop wire to the loop lead-in.
	+ If video/radar is use, all camera/radar locations should be noted in the quadrant notes. You may want to use the loop cell without line in middle to denote detection zones locations. There will be cameras placed on poles so that it is to the right side of the interior lane it is facing at. The radar shall be placed according to manufacturer’s recommendations (may need two antennas on an approach with GES and stopbar loops). All antennas and camera locations should be noted in the quadrant notes.
	+ If Sensys detection, a circle (phase #) should be place in each for the installation of each in pavement detection device. There will be 3 circles (pucks) per stopbar loops and 1 circle (puck) per GES loops. All antenna locations should be noted in the quadrant notes. The main antenna should be placed on the closest pole near the cabinet.
* Place conduits and junction boxes for underground crossings and loops (if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet), . Use the button pallet under Tasks to get Cells.
	+ Place junction boxes for underground wire runs to each quadrant for the mast arm pole installation. Typical junction boxes will be junction box type A and type C for underground running of the wiring. Note the different sizes of the type A/C in the standard drawings. Use type C if number of conduits into the box are more than 6 in and out of the box, otherwise use type A. typically use 3” to 4” Rigid Steel conduit for these crossing but can be multiple 2” conduits. There shall be a spare conduit added for the main line crossings. Try to have crossing conduits come to a junction box not poles or cabinet.
	+ The standard 4 - 2” conduits from the cabinet should go to the near pole or the prefered junction box. These can be changed to 2-3” or 4” for quantity matching.
	+ Place junction boxes (Type B) at the right side of each loop in the road. The junction box can be used for more than one loop. If there is an entrance in the run of the GES conduit, typically we add a junction box on each side of the entrance (paved). This conduit shall be a minimum of 2”
	+ Typical conduits size shall be 1 ¼” except when it is under the roadway and it shall be 2” for loops installation conduit.
	+ Use conduit sizing.xls for conduit sizing. (Under design resources). This should be used to verify that a 1 ¼” conduit is correct or any other conduit because of all the underground.
	+ Junction boxes shall be parallel with the road or curve it is near.
	+ The junction boxes shall be placed in utilities strip or behind the sidewalk or near edge of the shoulder if right-a-way is available. Do not place junction boxes in drainage areas.
	+ Typical GES approaches will have 1 left turn loop, 2 near loops, and 2 back loops, the conduit from the pole to the left turn junction and to the near loops is 2” and beyond that will be 1 ¼”
* Place all traffic note and legends cells from traffic workflow task bar(if ORD place poles on design model, it should be a gray background and go to KYTC ribbon to get Traffic signals pallet).
	+ Quadrant notes (1 for each quadrant)
	+ Loop schedule
	+ Wiring schedule
	+ Signal legend (need to drop to change but regroup after revised)
	+ North arrow
	+ Signal heads legend (need to drop to change but regroup after revised)
	+ Flashing yellow note
	+ Pole schedule or school schedule. Get pole heights, attachment heights, and moments form Salsa thin report.
	+ Breakline cell for GES loops. You will use two per break.
	+ Add direction arrows for all lanes approaching the intersection.
	+ For any other notes use the 20 scale note button and use the leader button. All notes and lines shall be on cadd standard level.
* Modify notes and legends
	+ All quadrants that have items installed on them should have a quadrant note. See typical notes in traffic workflow task bar.
	+ Specify underground conduit in quadrant notes
	+ Add stations for all poles (except pedestal) in quadrant notes
	+ Add phase # to all signal and pedestrian heads and loops. Each junction box shall be numbered.
	+ Note any conduit that is different from the typical conduit on legend.
	+ Scale all poles, cabinet, pedestals, junction boxes so that they can be read on a 20 scale. May have to print out on 11x17 to see if scale is enough.
* Leave street names for all approaches. May have to rotate.
* Enter a description into the bottom right of the SP sheet: EX. Signal plan for (Main) @ (Cross)
* Enter County, Item number, Sheet number in top right of SP sheet.
* Enter cadd standard sheet name in bottom left of SP sheet. Do not drop the sheet because esheets will not work.
1. Leave individual plan sheets open and do estimate (the same in ORD but do in design model)
* (current) Signal and Lighting Estimate.xls (under design resources/construction cost estimates)
* Pick signal tab at the bottom.
* Remove all items that are not required for the signal(s) **(do not do in ORD, use off by element in level display)**
	+ May use Open cut for Mast arm poles if existing pavement or in downtown area.
	+ Use bore and jack or trenching and backfilling if new pavement or area that bore and jack can be done.
* Open Signal Quantities Estimator(under design resources)
* Start with first tab and begin estimate process. There should be a separate signal quantities estimator for each signal in the plan set.
* Move final estimates from Signal Quantities Estimator to Signal and Lighting Estimate.xls. There should be an individual column of quantities for each signal in the plan set. There should be a total column included.
* Fill out all items at the top of the estimate spreadsheet (enter project numbers)
* Open Project install items.xls (under design resources/ construction cost estimates)
* Fill out install list and remove items that you are not using
* Open Project release of warehouse material form.xls (under design resources/ construction cost estimates) and copy all install items on this the new project recommendation sheet. Do not includes the prices or final costs.
* Open internet explorer to PNS 2006; http://kytcintra/PNS/ ; click on programs under construction; under search choose SYP Number; type item number in for blank space ex. Item number 3-317.00 type 030031700; after that fill out top portion of install list (Function and Fund). If project construction program number is not available, use the design program code and remove the “D” on the end of it and replace with “C”. If no design program number is available, do not fill these items out.
1. Open ALL Signal Standards.dgn. **(Not done in ORD)**
* Add each plan sheet for each intersection as a model. Rename each model to: Signal plan for Main @ Cross.
* Delete the standard details that will not be used in this project under models.
* Renumber models so that you can number each sheet cell (Ex T1- ). They should be number according to current standards.doc (under design sources/signal and lighting standard detail sheets). Make sure to check with project manager to make sure that there are no signing plans in the project because this may change your starting number for your T sheets.
* Each sheet cell for each detail and plan sheet shall have county, item number, e-sheet number, and e-sheet name. for e-sheet name (EX T00100SU) see cadd standards or current standards.doc
* Make sure that you fill-in the bottom right hand data fields on the plan sheets for the signals with the main street/cross street- should read “Signal plan for (Main) @ (cross)”
* On first sheet (Quantities/bid notes) add project numbers, date submitted and designed by in right hand corner; cell stpl from sheet cell library.
* Remove all references and rasters from each model.
* Leave dgn open, under file update file to the server.
1. Final plans turn In
	1. Old Microstation:
* Open projectwise- export (all signal standards.dgn) to a folder on your desktop
* Follow instructions for sheets under design resources folder – TO USE E-SHEETS.docx
* Check that after e-sheeting you have all the files that you need.
	+ You may have to check if the fill is on because some will not show on the pdf.
	+ If the fill is not on, the individual sheet may have to be undone.
	+ Use Print/plot to redo individual pdf for the sheets that are wrong.
* Move e-sheet folder from desktop to ProjectWise folder under Documents/Central Office/Traffic Operations/Branch-Design Services/District/ Signals- see 2a
	1. Ord
		+ Make sure that all county/items number/sheet numbers/plan sheet description have been filled out.
		+ Make sure that all unwanted levels have been turn-offed by Off by Element.
		+ Open Explorer, use search ribbon to find
		+ Go to sheet index tab/expand, open workset arrow, you will see the plan sheet below. Make sure that standards and design sheets are in the right order. If not you can drag the sheet around to get them in the right order- you will have to to hit button to open sheet index to edit to move sheets. To verify that sheet numbers changes, you can double click on sheets in index or you can go to each sheet model to check.
		+ If you edit you will have to hit button again to make read only
		+ Next hit print organizer button, make sure that you are on the main directory.
		+ Box will pop up and you should see your sheets in there, go to file and did print (you can do print preview if you like before printing)
		+ Print box will come up- note where the destination is and that is where the pdf will be. You also can check the open print file after creation to look at it.
	2. Note that all final designs shall be sent to the project manager so that he can turn in with final set. If you need to you can move files to the folders to turn them in.
	+ Also move e-sheet folder on desktop to projectwise folder under Documents/Projects/District/item number/contract plans and proposal/contract plan set/traffic/ Signals
	+ Also move final estimate and project install items/project release to projectwise folder under Documents/Projects/District/item number/contract plans and proposal/miscellaneous
	+ Also move Project release to projectwise folder under documents/projects/district/item number/contract plans and proposal/proposal- make pdf.
	1. Email Project Release sheet to Scott tingle and ask him to add to proposal for the project.
	2. Email Project install items to Kerry Decker.
	3. Email Estimate and Project install Items to Travis Jones and Lindsey Carter.
1. FAA and KAZC permits
	1. Open blank Excel Spreadsheet
		* Add columns for Northing, easting, LAT, Long, elevation coordinates from Mircostation for each signal pole.
		* Northing and easting coordinates only convert into LAT/LONG deg,min,sec (ex. Remove the degrees, minutes, and secs symbols, 38 12 12.123 -85 34 23.12 (add negative sign)). You can use <http://kgs.uky.edu/kgsweb/CoordConversionTool.asp> to convert. Check if coordinates are close enough to location by bringing up the map on this website.
		* Email excel spreadsheet to Jason.Salazar-Munoz@ky.gov or Randall.Royer@ky.gov at KAZC to see if we need to apply for a permit. If his response is a no, you just need to keep email for the records. If his response is a yes, you will need to do the following;
			1. Get and fill out the permit application (TC 55-2) from the website. <http://transportation.ky.gov/Aviation/Pages/Zoning-Commission.aspx>
			2. On this permit just fill out one location and add in comments that there are multiple locations. You will need to attach the spreadsheet to your submittal
			3. Send permit to Jason/Randall to process and he will send to the KAZC commission for review.
			4. There may be follow-up after the structure is installed.
		* If the answer from KAZC is yes. Input all locations in to the FAA Notice criteria tool, <https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showNoNoticeRequiredToolForm>
			1. Add column to spreadsheet to note if the tool requires a FAA permit.
			2. If the tool requires permit, you will need to get a login ID and fill out a permit for each location. Make sure that you make KYTC the sponsor and add Ted Swansegar as the contact for the Sponsor.
			3. You may be required by the FAA to update or modify your information that has been turned in on the permit.
			4. FAA also will require you to turn in a PART 2 submittal after the structure is installed. If the structure is moved in the field, a new permit shall be submitted to the FAA. You will need to terminate the existing location permit.
		* If the answer from KAZC is no. Input all locations in to the FAA Notice criteria tool, <https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showNoNoticeRequiredToolForm>
			1. Add column to spreadsheet to note if the tool requires a FAA permit.
			2. If the tool requires permit,
				1. Does the map on the screen show a heliport? FAA has jurisdiction over all private and public heliports. KAZC only has jurisdiction over public heliports (Kentucky has no public heliports). A heliport will look like a perfect circle on the map. Usually the airport will have an eclipse and an approach block.

If yes you will need to file for a permit for all locations. Go to step 3.

If no you will need to document that you do not see a heliport surface. Then you would need to document (with photos and added to file) if location fits within the 77.9 e 1 requirements to not file a permit:

(e) You do not need to file notice for construction or alteration of: (1) Any object that will be shielded by existing structures of a permanent and substantial nature or by natural terrain or topographic features of equal or greater height, and will be located in the congested area of a city, town, or settlement where the shielded structure will not adversely affect safety in air navigation; You are done.

* + - 1. You will need to get a login ID and fill out a permit for each location. Make sure that you make KYTC the sponsor and add Ted Swansegar as the contact for the Sponsor.
			2. You may be required by the FAA to update or modify your information that has been turned in on the permit.
			3. FAA also will require you to turn in a PART 2 submittal after the structure is installed. If the structure is moved in the field, a new permit shall be submitted to the FAA. You will need to terminate the existing location permit.