

Constructibility Review Unit

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DRAINAGE, SOILS AND FOUNDATIONS

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
The project drainage system was supposed to tie in to an existing large diameter culvert pipe (located outside the project limits) but it was found to be deteriorated	Work was added to the contract to repair the pipe using Cured in Place Pipe Lining	Conduct a site visit to review condition of existing drainage that is being tied in to; arrange a walk-through of large diameter culverts
Plans show large diameter pipes (42" RCP) entering & exiting drainage manhole; pipes would not fit	Item added to contract to install 6' Diameter Manhole	Anticipate need for larger diameter manholes when pipes over 36" diameter are specified
The existing soil at the south abutment footing was saturated and soft	Crushed stone was added to the area	Include direction in plans for such possibilities
Material excavated from drainage trenches was found to be contaminated but was not included in estimate for handling & disposal	Another Waste Stockpile Area was added to contract; handling & disposal items were greatly increased	Add trench excavation quantities within AOEC's to contaminated materials quantities
Backfill with removed material was not possible due to contaminated material	Additional granular fill was brought in	When trench excavation occurs within AOEC's, assume new material will be needed
After initial grading, three private properties had steep, unstable cut slopes	A retaining wall was designed and built	Slope materials that are close to the design limit (1 1/2 :1) should be scrutinized closely
The drainage pipe diameters shown on the plans differed from those shown on the DEP Permit	Contractor was ordered to install larger diameter pipes even though the smaller pipes were already delivered increasing costs on the project	If the DEP Permit is obtained late in the process, the District Construction staff should be made aware in an effort to avoid ordering the wrong materials
Design assumption was that rock was "solid" at slope but it was not	Some areas were sloped further back and crushed stone was used in lieu of turf; a retaining wall was also used	More soils investigation work may have helped determine competency of the rock
Plans showed 600 mm RCP curving along corner of road to connect to CB in intersection	Actual construction included straight runs of pipe with two manholes to make drainage turn corner with less disruption to travelway	If curved piping is needed call out something more flexible than Reinforced Concrete Pipe
Existing drainage swales (not addressed on the plans) made the underlying material wet and unsuitable in the area where the new ramp was to be installed	Extensive, additional drainage had to be designed and installed and the existing topsoil layer was replaced with suitable gravel fill	Site visit should include walking through the actual work areas; the swales were also visible on Maps.Live

BRIDGES AND STRUCTURES

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
Plans did not address support of existing catenary wires (attached to bridge) during demolition or in final condition	A temporary support system using cantilevered steel sections was designed and installed	As older project plans are pulled from “the bin” reviews should include any site conditions that have changed
Environmental Health and Safety special provision was generic and did not address work to take place within the segmental concrete bridge sections, a confined space	Contractor had to address confined space issues in their HASP and successfully argued that it was unclear during bid process	Ensure that the special provisions address the actual site conditions; if the spec says AOEC’s make sure they are identified on the plans
Some of the deck repair patches including replacement of deteriorated rebar had to be done in stages	Dowel bar splicers were added to the contract	After stage construction is designed, review whether work items are broken up
Newly constructed abutment and wingwalls started to move during backfill operations	The bridge deck had to be installed before backfilling due to integral abutment design	A prominent note should be added to the plans; there should also be some direction as to contractor access when backfill is not allowed
Plans noted that sheeting could not be installed by vibratory methods	The designer was consulted and allowed installation by vibratory hammer but not removal to avoid settlement of new wingwalls and abutment	The special provisions or note on the plans could have saved time and allowed for vibratory installation but not removal
Joint installation instructions were not described in the special provisions - only a reference to the manufacturer’s instructions which were not readily available	The project was delayed until the proper installation methods could be clarified by the manufacturer	Provide as much specific information as possible; not all projects have access to field office amenities such as the internet
The bridge design did not account for two stage construction and there were problems due to the complexity of the design (skewed abutments, curved girders with camber)	Dowel bar splicers were added, diaphragms were reconfigured and other structural changes were made	Develop stage construction drawings anticipating temporary support conditions and longitudinal joint
Movement between box girder sections allowed water to seep through the woven glass membrane (normally it would not be a problem but this culvert was installed for pedestrian passage)	Not pursued under this project; maintenance personnel alerted to possible deicing operations needed in winter	Specify a more flexible type of waterproofing for this application of box culverts
Plans did not provide for closing off ends of cofferdam to allow for dewatering	Increase of Cofferdam and Dewatering item to close off ends of cofferdam at the box culvert closure pours	Installation of closure wall concrete requires work in the dry

PERMITS AND ENVIRONMENTAL

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
Costs for Handling Contaminated Groundwater significantly exceeded the estimated quantity with no end in sight	Crushed stone was placed around the completed footing allowing the abutment wall work to proceed without pumping	Design and construction personnel should be made aware of this solution and use it if feasible to reduce costs
A condition of the DEP Permit was to remove invasive plant species but the item was not included in the original contract	The item was performed on a cost plus basis	Items required by the DEP permit should be included in the original contract
There was no item for Relocation of Snails which was a condition of the DEP Permit and was discussed in the Notice to Contractor included in the contract documents	An item was added to the contract causing project delay	Inclusion of an "EST" item could have been done; maybe no cost savings but time savings could have occurred
Wetland mitigation area plants were being eaten by deer soon after installation	A temporary protective fence was installed until plants could be established to DEP's satisfaction	Anticipate need for protective fencing item in the contract
Local roadways were being caked with sediment from the construction activity	Anti tracking pads were added to the contract	Provide tracking pad item at construction access points; include a note on the plans that tracking pads are to be installed as directed by engineer
Topsoil three month storage specification to observe possible invasive plants was unrealistic for this five month project	Additional new topsoil was furnished and installed	Be aware of time required by special provisions for environmental items
Arrangements had to be made to dispose of controlled materials in the Hartford Landfill (ordered by OEP); sediment had to be stored	Waste Stockpile Area item was added to the contract so that work could progress	Look for indications that an environmental assessment is needed (Q - Aren't all sites reviewed for AOEC's?)
A condition of the DEP Permit that allowed in-water work to be performed at times that would otherwise be restricted was not included in the original contract	Turbidity Control Curtains were added to the contract	Ensure that all permit condition items are included in the contract
Handling of contaminated soil and groundwater was not anticipated in the original contract	Dirty dirt items added to the contract adding time and monetary costs	The existing gas station within the project limits should have been taken into account and the environmental survey should have been more extensive
The original completion date was in September but the special provisions stated the season for planting did not begin until October 15th	Contractor was granted a time extension to accomplish this work item	Thorough reading of the special provisions and possible changes to contract time / advertising and/or Notice to Proceed date

TRAFFIC AND ELECTRICAL

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
Plans did not show interconnect cable between traffic signals	Items were added to maintain and move it during and after the bridge reconstruction	In urban settings anticipate that signals may be interconnected and plan for maintenance
All the conduits entering the handhole could not fit per plans	Additional handholes were installed and some of the conduit runs were redirected	Specify larger type handhole if warranted by number and/or sizes of conduits
Ledge just below the surface hampered pole installation	Rock drilling was performed and annular space was backfilled with concrete	Ledge outcrops in the area can be observed during site visit and rock drilling can be specified in advance
Traffic needed to be protected from 16" drop-off along the gutter at the intersection; plans did not include any staging	Temporary precast concrete barrier curb was incorporated into the contract	On multiple intersection plans, give some consideration to field conditions that will occur and plan accordingly
Plans called for installing new cable through the existing conduit; often that conduit could not be cleared	Sections of the existing conduit had to be replaced	Using new conduit from the onset would have prevented time delays
Larger size cables called for in the contract would not fit in the 2" conduit shown on the plan	Larger conduits were added to accommodate the cables	Be sure conduit and cable sizes are compatible
Contractor used State's proprietary manufacturer as an excuse for problems	Lesson to be learned for future projects only	If possible allow contractors to choose from various manufacturers then they will be responsible for the selection
Contract time only allowed for 12 days per intersection	Time extension	Allow at least 24 days per intersection for inspections and hook up by electric utility
Trafficperson item greatly exceeded estimated quantity	Item increases entered for multiple intersection locations	Consider that each day of signal work requires traffic control either by two Trafficpersons or officers
Traffic signal pole foundations could not be installed in the locations shown on the plans due to many utility conflicts	Pole foundations were field located increasing many item quantities	Avoid developing plans from old intersection plans; put more effort into site investigations
Special provisions listed one proprietary manufacturer for certain components but coordination between them and the contractor was problematic	Contractor granted additional compensation and time for delays caused by the manufacturer	If possible, allow contractor to pick from various manufacturers - they will be responsible for the selection and won't use the State's proprietary manufacturer as an excuse for problems

UTILITIES

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
Proposed drainage was found to be in conflict with existing utilities	Test pits added to contract to decide how to proceed; an offset manhole was placed and the catch basin was tied in to it with a thinner walled pipe to avoid the gas main	In urban areas with multiple utilities, a test pit item should be included in the original contract; if added later it can become expensive
UI found that there was not enough slack in their cables to relocate as planned	Splicing of cables caused considerable project delay	Thorough planning with utility representatives during design
Multiple utility pipes crisscrossing project area where drainage had to be installed	Test Pit item was essential in locating the numerous utility pipes in the intersection and resolving drainage relocations	This project had Test Pit in original contract - Reaffirms that it should be included where utilities are difficult to pinpoint
Existing sewer service would not have required depth once construction of the new road was complete	A change order was issued to lower the existing sewer to meet WPCA requirements	Where existing utility services may be affected by road reconstruction, include Service Connections item in contract
Plans showed proposed drainage pipe installed underneath and in line with existing sewer pipe which was unstable	Temporary support of the pipe was added to the contract; the contractor was compensated for lack of productivity in this area	Avoid designing drainage pipe under existing sewer lines unless it is known that the sections are of sufficient length (i.e. 18 ft) and the pipe material is durable enough (i.e. ductile iron) to allow for excavation below it
During installation of 36" RCP there was concern that the utility poles could become unstable	Temporary support for the poles included guy wires attached to large concrete blocks	Review factors such as depth of pipe, proximity to existing utilities and provide for support if deemed necessary
An existing fire vault was in close proximity to the proposed retaining wall footing	Added test pits, temporary earth retaining system, 8" water service piping and revisions to wall plans	The vault was not an unforeseen condition; could have been addressed in original contract
An existing traffic signal interconnect cable had to be relocated to facilitate relocation of UI fiber optic cables and keep the utility portion of the project on schedule	Additional traffic signal conduit and wiring items; slight delay to project	Closer coordination between adjacent projects and utilities
Existing sanitary sewer service locations not depicted on the plans conflicted with proposed drainage pipe installation	Service Connections item increased and contractor's production slowed significantly	Anticipate service locations especially in urban areas; if possible, show on plans

ROADWAY (PAVEMENT, SURVEY AND STAGED CONSTRUCTION)

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
During Stage 1 water was trapped in travelway on bridge causing hydroplaning concerns	Overlay was added to existing bridge deck to force standing water to gutter	Review cross sections of various stage roadways and include items to eliminate ponding areas
Staged construction called for traffic to run on first lift of pavement with final overlay and curbing installed in last stage but runoff would have been a problem without curb	A 7" high curb was installed in areas where runoff was causing erosion near the wetlands	Call out a taller curb where needed in stage construction and include item in contract
The design did not anticipate concrete pavement under the bituminous material	In Stage 1 concrete pavement was cut and removed; milling was used in Stage 2 to save time and money	If a site visit is not possible, a quick check for uniform pavement joints can be done using Photolog
Contract did not specify way to protect adjacent residents during the various stages of the project	Modifications were made to temporary traffic signals	Anticipate protection of local traffic for each stage of construction
Plans called for stop sign control of alternating traffic but there were sightline and safety concerns during Stage 2	Added Temporary Traffic Signals for Stage 2 at a significant cost	Review sight lines in the various stage configurations of the project
Staging plans called for moving traffic onto the shoulder but did not provide for removing rumble strips or protecting existing catch basins from the traffic	Removal of rumble strips, heavy duty lock down catch basin tops and paving added to contract	Could have anticipated the need for these items and included in original contract
The plans showed an incorrect invert elevation for the proposed drainage; redesign to avoid utilities would involve greater depths of excavations and road closures	The contractor proposed and the Department accepted a plan to jack drainage pipes under the road to avoid these problems	Connecting proposed drainage to existing structures should be fully investigated in the survey and design phase
The plans did not identify topsoil as unsuitable material but it had to be removed before embankment could be placed (2 locations) or roadway could be construction (2 more locations)	Removed topsoil was excess and had to be disposed; additional gravel fill was used to place topsoil	Assume that topsoil will not be suitable to build on and include removal, reuse and/or disposal items where needed
Finished fill slopes were close to Pond causing OEP to be concerned about impacting wetlands; redesign included shifting the road away from the pond resulting in a sharper curve requiring superelevation	Drainage and road base that had already been installed had to be reworked	If possible, show edge of pond on cross sections to determine if fill slope will be too close to pond and change road location during design phase
Estimated quantity for sedimentation control system was based on final plan, not actual stages of construction	Controls were added during the various construction stages greatly increasing the item	Consider all stages' potential for erosion and design sedimentation controls for each

RIGHTS OF WAY

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
A buried layer of bituminous pavement was found in the drainage Right of Way	The pavement was trucked away and suitable backfill was used over the pipe	Site investigation during design may have found the pavement layer, provided item for removal and saved time
During contractor's stake out of property lines it was discovered that some of the spur line work was off Amtrak property	The owner agreed to allow the contractor to perform the work on their property causing delay and additional costs (track work was to be done by Amtrak <u>if</u> it had been their track)	Property ownership investigation should be accomplished prior to or during design phase
DOT Rights of Way had agreed to install metal railings (replacing existing wood railings) at a concrete stairway that was proposed to be reconstructed	Metal railings were added to the contract	There could be better communication between ROW personnel and designer
The abutting property owners (Condo Association) requested additional trees to provide the privacy hedge which they were shown during negotiations of their Right of Way agreements	Additional arborvitae were installed as shown on the Taking Plan for this location	Coordination between Taking Plans and final project plans
Thickness of commercial concrete driveway ramps on City property was not up to their standards	Thickness increased from 8" to 9" thereby increasing costs	May have been overlooked during plan review process; determine which standards govern project during design
During the design phase, commitments were made to the City to provide 3 new bus shelters and to relocate one shelter but they were not shown on the plans and there were no pay items	Items were added; there was some lead time in obtaining the materials	All commitments should be communicated to the designer who should ensure they are addressed on the plans

VERTICAL, RAILROAD, AIRPORT AND TRANSIT

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
Roof curb heights were not as shown on the plans	Additional time and costs to resolve discrepancies	Thorough review of existing curb heights; site survey should be done if possible
Discrepancies between architectural and structural drawings were discovered	Consultation with designers to resolve problems during construction phase	Coordination and thorough reviews during design phase
Plans did not show correct dimensions of the salt shed	Design changes and delays	Site visit including verification of as-built dimensions
Plans did not provide enough information on runway grading	Addressed by field personnel during construction delaying final paving	Cross sections, profiles and grading plans should be provided for runways
Cross sections or profiles for utilities crossing the runway were not provided in the plans	Drainage lines were relocated after determination of various utility pipes' depths	Provide as much utility depth information as possible - sometimes test pits are not an option on busy runways and taxiways
There were no cross sections showing the intersection of the two runways	Project work was delayed until information was provided	Cross sections, profiles and grading plans should be provided for runway intersections
Specified SuperPave mix did not hold up well under normal airport traffic; helicopters, fuel delivery trucks, jack stands and other everyday usage items have damaged it	None pursued under this project	All areas of airports (including hangar approaches and aircraft parking areas) should receive runway quality pavement mix design
FAA restrictions were imposed during work at cast in place endwall within airport's zone of influence; it was not anticipated in the original contract	Contractor was compensated for Airport Downtime Delays	Could have been researched (FAA website or consultation with airport staff) and included in a Notice to Contractor
The gutter called out in the plans was more applicable to a new metal roof deck, not the station's existing asphalt shingle roof which was to remain	Item added to provide similar aesthetics to the existing roof gutter system	Visit the site with intent to review work to be done and materials to be used in rehab of existing facilities

PROJECT COST OVERRUNS

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
Engineer's Estimate did not include pavement cuts for utility work and drainage work which was extensive	Items increased substantially	Designer should not assume that the drainage and/or utility work will occur simultaneously with road reconstruction
The material excavated from drainage and utility work trenches within AOEC's was not included in the Engineer's Estimate for Handling and Disposal of Controlled Materials items	Items increased substantially	Any excavations within AOEC's should be included in the estimate for handling and disposal of dirty dirt (not just roadway excavation)
Temporary pavement over drainage trenches was not included in original contract	Item added to contract	When proposed stage construction drawings show drainage installed prior to road reconstruction, include temporary pavement item
Larger sized manholes were shown on the plans but not included on the bid form	Contractor was directed to install larger manholes on a cost plus basis	The Department usually gets a better price if the item is on the bid form; the contractor can plan their work and order their materials more efficiently
The amount of controlled material that required disposal was underestimated due to use of wrong unit weight in the Engineer's Estimate	Disposal item, expensive already, nearly doubled	Could this error have been caught during recheck of quantity calculations?
Concrete pavement was not anticipated by the designer	It had to be cut to install utilities and drainage and most was removed due to lower profile of the road	Site visit, borings and/or viewing the roadway on Photolog would help determine presence of concrete pavement
The steel repairs were more extensive than estimated because the plans were based on a 1999 ConnDOT Bridge Safety inspection report	Items increased substantially	Use most current data for estimate (This may have been a "bin" project)
Engineer's Estimate of quantities for concrete and rebar was based on "average abutment size" which was vastly different from actual design	Items increased substantially	Quantity computations should be taken from final design plans for project
Unit of measure for Partial Depth Patch was listed on bid form as cubic foot but estimated quantity was based on cubic yard therefore actual quantity was 27 times estimated	Renegotiated a unit price with the contractor; they had based their bid price on using a smaller mixer than what was actually needed	There should be a system in place to recheck big ticket item quantities for possible errors (QA/QC)
The plans called for installation of most of the drainage prior to road reconstruction but the estimated quantities were based on the proposed lowered roadway elevation	Trench and Rock Excavation over 20' Deep items added to the contract	Base items and quantities on actual conditions that will be encountered in the field, not final condition

TIME EXTENSIONS AND CLAIMS

<u>PROBLEM</u>	<u>SOLUTION</u>	<u>RECOMMENDATION</u>
Special Provision was unclear and plans did not identify pay limits for temporary sheet piling	The contractor won their appeal to the Contract Board of Review to be paid again in Stage 2 for a line of sheeting installed in Stage 1	Review specs being used and ensure pay limits are clear
Work was added to the contract after the construction was 75% complete	Contract time was extended through the winter into the next construction season	Notify Construction personnel as soon as it is apparent that work is going to be added; if possible, share preliminary info
Time of Year restrictions in the DEP Permit did not allow stages to proceed as scheduled	Additional time was added to the contract to complete the in water work and the remaining bridge and roadway items	Allow extra time where in water restrictions are expected and/or try to control release of project to optimum advertising/ bid / Notice to Proceed date
The additional work on the west parapet of the bridge extended the contract time beyond the original completion date affecting more items than the designer included on the C.O. Initiator memo	Not only was the contract time extended, field office and M&P items were increased and Lead Health item had to be added	Be aware of all ramifications of adding work to existing contracts
Original contract time was not enough for coordination of airport shutdown	Time extension granted to contractor	Additional time should be anticipated for an international airport shutdown in order to accommodate inbound and outbound flights and the affect on connecting airports, the additional security, police and fire personnel, additional maintainers as well as time of year and local and statewide events that may be affected