ARROWHEAD
ENGINEERING, INC.

1685 S. SAN TODARO PLACE
TUCSON, ARIZONA 85713
PHONE: (520) 822-7702
FAX: (520) 777-3438

CONSTRUCTION SPECIFICATION AND BIDDING MANUAL

FOR THE
Kayenta Bus Route
Kayenta, Navajo County, Arizona

AEI No. 217-003

August 2nd, 2017

Prepared By:

Merwin T. Yellowhair, P.E.
Arrowhead Engineering, Inc.
1685 S. San Todaro Pl.
Tucson, AZ 85713
520-822-7702

CONSTRUCTION SPECIFCATION AND BIDDING DOCUMENTS
FOR KAYENTA BUS ROUTE
TABLES OF CONTENTS

PART 1:
INSTRUCTION TO BIDDERS

INSTRUCTIONS FOR BIDDERS

A. BIDS

All Bids must be submitted on the forms in this Bidding Document Packet furnished by the Kayenta Township and shall be subject to all requirements of the specifications and drawings contained herein. Bids shall be submitted in duplicate (one original and one copy). The following documents constitute a complete Bid and are required to be submitted by a Bidder in order to form a responsive Bid (as applicable):

- Bid Form (Exhibit A)
- Bid Bond (Exhibit B)
- Performance and Payment Bond (Surety Reference Letter signed by an attorney-in-fact for the Surety Company)
- Affidavit of Non-Collusion (Exhibit D)
- Contractor's Questionnaire (Exhibit E)
- Checklist for bidder compliance with the Township's Bidding Requirements

The Bid Documents shall be addressed to the Kayenta Township and shall also be:

- Sealed in an envelope; and
- Clearly labeled with the words "Bid Documents"; and
- Show the Project identification and name of Bidder.

General Contractor is responsible for determining tax requirements for this project.

B. INTERPRETATIONS

All questions should be submitted in writing to Arrowhead Engineering, Inc. attention: Merwin Yellowhair, 1 S. Church Ave, Tucson, Arizona 85701. Fax: 520-777-3438. Email: merwiny@arrowheadengineeringinc.com.
Necessary changes to the bid documents will be made by addenda, which will be sent to all known plan holders. Questions pertaining to the Project are due no later than August 9, 2017.
Oral interpretations of the bid documents are not binding.

C. BID GUARANTEE

All Bid guarantees shall be held for thirty (30) days after submission of the Bid. The Bid Guarantee shall not be less than five percent (5%) of the Bid amount in the form of a Bid bond secured by a surety appearing on the Treasury Department's most current Circular 570, as amended. The Bid Guarantee shall secure the Bid until a Contract award is made. Failure to furnish a Bid Guarantee in the proper form and amount, by the time set for the opening of Bids, shall be cause for rejection of the Bid.

D. AFFIDAVIT OF NON-COLLUSION

Each Bidder submitting a Bid for any portion of the Work contemplated by the Bid documents shall execute an affidavit, in the form provided by the Kayenta Township, to the effect that the Bidder has not colluded with any other person, firm or corporation in regard to the Bid submitted. The affidavit shall be attached to the Bid.

E. BIDDER'S CONSTRUCTION EXPERIENCE

Before a Bid is considered for award, the Bidder may be requested by the Kayenta Township to submit additional information regarding the Bidder's previous experience in performing comparable work, as well as information on the Bidder's business and technical organization and financial resources.

F. INDIAN PREFERENCE

Qualified Navajo owned firms are eligible to receive additional consideration in the award. Firms determined to be eligible will receive an additional 10 points on a 100 point evaluation system (or 10% of the total possible points if other than a 100 point evaluation system). Navajo organizations and Navajo owned economic enterprises are defined in Navajo Nation Business Opportunity Act, Title 5, Chapter 2, Section 205 and the selected firm shall comply with all applicable laws, rules and regulations of the Navajo Nation Business Opportunity Act N.N.C., Title 5, Chapter 2, Section 201 et. seq where applicable.

G. DELIVERY INSTRUCTIONS

Bids will be accepted in the form of a sealed envelope that is clearly labeled "Sealed Bid for the Kayenta Bus Route Package" no later than 11:00 A.M. DLST on August 14, 2017, at Kayenta Township Office, Kayenta, Arizona. Bids will be publicly opened and read. No telegraphic or facsimile documents will be accepted.

Hand Delivered sealed Proposals should be addressed to, and will be received at the following address.

Delivery of sealed Proposals using Registered mail, or Overnight Services should be received at the following address 24 hours prior to official due date.

The address is as follows:

Kayenta Township
100 North Highway 163, Box 1490
Kayenta, AZ 86033
Attention: Heston Zonnie

H. CHECK LIST FOR BIDDER COMPLIANCE WITH KAYENTA TOWNSHIP'S BIDDING REQUIREMENTS

All Bidders must review and initial items below. This list is NOT inclusive of all items required for a Bidder to submit a complete Bid Package. The Bidder is responsible to read and comply with all items contained in the Bidding Requirements and Contract. The following is a listing of some of the major items required and must be initialed below by the Bidder:

__ Bid Form (Exhibit A)

__ Bid Bond (Exhibit B)

__ Performance and Payment Bond (Surety Reference letter signed by an attorney-in-fact for the Surety Company)

__ Non-Collusive Affidavit (Exhibit D)

__ Contractor's Questionnaire (Exhibit E)

__ Construction Drawings and Project Manual

__ Copy of General Contractor's Arizona Contractor's License

__ The Bidder has read and understands the general conditions and terms of the Contract and all of the Exhibits and Appendices.

__ Indian Enterprises Qualification Statement (Exhibit F)

__ Bid Pricing to breakdown Bid Form (Exhibit G)

I. TIME FOR RECEIVING BIDS

Bids received before the time of the Bid opening will be securely kept and unopened. No responsibility will be attached to Kayenta Township representative for the premature opening of a Bid not properly addressed and identified.

J. WITHDRAWAL OF BIDS

Bids may be withdrawn upon written request of the Bidder received prior to the time fixed for opening. Negligence on the part of the Bidder in preparing the Bid confers no right of withdrawal or modification of the Bid after such Bid has been opened.

K. AWARD OF CONTRACT: REJECTION OF BIDS

The Contract will be awarded to the most responsive and qualified Bidder submitting the proposal which complies with the conditions of the Invitation for Bids and Instruction to Bidders. The Bidder to whom the award is made will be notified at the earliest practicable date. The Kayenta Township reserves the right to reject any and all Bids and to waive any informality in Bids received whenever such rejection or waiver is in the interest of the Kayenta Township.

The Kayenta Township also reserves the right to reject the Bid of any Bidder who has previously failed to perform properly, or to complete on time contracts of a similar nature; or who habitually and without just cause neglected the payment of bills; or otherwise disregarded obligations to subcontractors, material men or employees. The ability of the Bidder to obtain performance and payment security shall not be regarded as the sole test of such Bidder's competence or responsibility.

L. EXECUTION OF CONTRACT; PERFORMANCE AND PAYMENT BOND

The successful Bidder shall execute and deliver to the Kayenta Township a Contract in the form furnished by the Kayenta Township and in such number of counterparts as the Kayenta Township may require. Within 10 days after the date of the last party signature to the Contract, the Contractor shall deliver to the Contracting Officer and Insurance Manager the applicable form of security listed below:

1. Performance and Payment Bond

   The bond must be in a sum of at least the full amount of the Contract as awarded, and secure the faithful performance of the Contract and the payment of all persons, firms or entities to whom the Bidder may become legally indebted for labor, materials, tools, equipment, and services of any nature employed or used by the Bidder in performing the Work. On each bond, the rate of premium shall be stated, together

with the total amount of the premium charged. The current power of attorney for the person who signs for any surety company shall be attached to such bond.

2. Failure to Execute Contract or Obtain Security.

The failure of the successful Bidder to execute the Contract or to supply the required performance and payment security within the 10-day period prescribed above, or within such extended period as the Kayenta Township may grant, shall be grounds for the Kayenta Township to either award the Contract to another Bidder or re-advertise for Bids. In such event, the Kayenta Township may charge against the Bidder the difference between the Bidder's Bid amount (the "Bid Amount") and the amount of the Contract Sum for which a Contract is subsequently executed, irrespective of whether such Contract Sum exceeds the Bid Amount.

M. INSURANCE

Prior to the Commencement Date of the Contract, the General Contractor shall furnish the Insurance Manager and Contracting Officer with certificates of insurance confirming that the terms and coverages of the policies of insurance for the Contract are in full force and effect.

N. CONTRACTOR'S LICENSE

The General Contractor and all subcontractors are required to have construction contracting licenses issued by the Arizona Registrar of Contractors. A copy of the General Contractor's license shall be submitted as part of the bid.

O. PRE-CONSTRUCTION CONFERENCE

Within fourteen (14) calendar days after execution of the Contract and prior to the commencement of work, the successful Bidder shall attend a Pre-construction Conference with the Kayenta Township. The conference will serve to acquaint the parties with the general plan of Contract administration and requirements under which the construction is to proceed.

P. EXHIBITS A THROUGH G (ATTACHED)

BID FORM

PROJECT NAME: Kayenta Bus Route Package

TO THE: Kayenta Township

1. The undersigned, having been familiarized with the existing conditions at the site of the Work, and with the Contract Documents, which include in part the Invitation for Bids, Instructions to Bidders, this Bid, the Bid Bond, the Non-Collusion Affidavit, the requirements for Performance and Payment Security, the Construction Documents, any applicable Special Conditions, Specifications and Drawings and exhibits and addenda, if any thereto, and on file at the Kayenta Township, hereby proposes to furnish all supervision, technical personnel, labor, material, machinery, tools, equipment, fixtures, and services including transportation services, and to perform and complete all work required within the time specified in the Contract Documents for the sum shown below.

2. The undersigned acknowledges receipt of the following addenda:

Date	Number
_____	_____
_____	_____
_____	_____

BASE BID: _____

State of Arizona Tax
(6.1% of Bid Subtotal): _____

TOTAL PRICE OF BASE BID: _____

TOTAL PRICE OF BID: $_____
(Base Bid, and State of Arizona Tax)

WRITTEN SUM: _____

1. Attached hereto as Exhibit B is the Bid Bond.
2. Attached hereto as Exhibit D is a fully executed Affidavit of Non-Collusion.
3. Attached hereto as Exhibit E is a fully executed Contractor Questionnaire.
4. If applicable, attached hereto is Certification of Navajo Owned Business.
5. Checklist for Bidder compliance with the Township's bidding requirements (Instructions for Bidders: Paragraph H)

NAME OF BIDDER (Typed or Printed)

OFFICIAL ADDRESS:
_____

BY: _____
TITLE:_____
Signature Authority to Submit this Bid

NOTARY CERTIFICATION:

Signed before me on this _____day
of_____

_____Notary Public

My commission expires:
_____

BID BOND

We, the undersigned, _____, as PRINCIPAL, and _____, as SURETY, are held and firmly bound unto the Kayenta Township, in the penal sum of $_____ (the "Bid Bond"), lawful money of the United States, for the payment of which sum will and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally.

WHEREAS, THE CONDITION OF THIS OBLIGATION IS SUCH, that the Principal has submitted this accompanying Bid, dated_____, for the Kayenta Bus Route Package. The Bid Bond is equal to five percent of the Bid.

NOW, THERFORE, if the Principal shall not withdraw said Bid within the period specified therein after the opening of the same, or, if no period is specified, within thirty (30) days after said opening, and shall within the period specified therefore or, if no period is specified, within ten (10) days after the prescribed forms are presented for signature, enter into a written Contract with the Kayenta Township in accordance with the Bid as accepted, and give the required performance and payment security for the faithful performance and proper fulfillment of this Contract; or in the event of the withdrawal of said Bid within the period specified, or the failure to enter into such Contract and give security within the time specified, the Principal shall pay the Kayenta Township the difference between the amount specified in said Bid and the amount for which the Kayenta Township may procure the required work or supplies or both.

IN WITNESS THEREOF, the above parties have executed this instrument this _____day of _____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____

Principal Signature, Printed Name, Title

_____

Surety Signature, Printed Name, Title

NOTARY CERTIFICATION

Signed before me this _____day of_____

_____

Notary Public

My commission expires_____

Note: THIS DOCUMENT IS NOT VALID UNLESS A PROPERLY EXECUTED POWER OF ATTORNEY FOR THE SURETY'S SIGNATOR IS ATTACHED HERETO.

PERFORMANCE AND PAYMENT BOND

KNOW ALL PERSONS BY THESE PRESENTS: THAT we,

_____

as PRINCIPAL, and
_____as SURETY are bound onto the Kayenta Township, in the penal sum of ($_____) for the payment of which sum we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally;

WHEREAS, Principal has entered into a certain Contract with the Kayenta Township,

Dated_____, a copy of which is hereto attached and made a part hereof.

NOW THEREFORE, the condition of this obligation is such that if the Principal shall in all respects fully perform the Contract and all duly authorized modifications thereof, during its original term and any extensions thereof that may be granted and during any guaranty period for which the Contract provides, and if the Principal shall fully satisfy all claims arising out of the prosecution of the Work under the Contract and shall fully indemnify the Kayenta Township for all expense which it may incur by reason of such claims, including its attorney's fees and court costs, and if the Principal shall make full payment to all persons supplying labor, services, materials, or equipment in the prosecution of the Work under the direct right of action; and if the Principal shall pay or cause to be paid all sales and use taxes payable as a result of the performance of the Contract as well as payment of gasoline and special motor fuel taxes in the performance of the Contract and all motor vehicles used in connection with the performance of the Contract, then this obligation shall be void; otherwise, it shall remain in full force and effect. No modification of the Contract or extension of the term thereof, shall in any way release the Principal or the Surety from liability hereunder.

The rate of the premium on this bond is $_____per thousand dollars and the total premium charge is $_____.

IN WITNESS THEREOF, the herein named Principal and Surety have executed this instrument and affixed their seals hereto, this _____day of_____

_____
Principal Signature, Name, Title

_____
Surety Signature, Name, Title

NOTARY CERTIFICATION:

Signed before me this _____day of _____of _____

_____
Notary Public

My commission expires:
_____

NOTE: This document is not valid unless a properly executed power of attorney for the surety's signator is attached hereto.

AFFIDAVIT OF NON-COLLUSION

State of _____)
County of_____)

_____, being first duly sworn, deposes and says:

That s/he is _____, the party making the foregoing proposal for Bid, that such proposal or Bid is genuine and not collusive or a sham; that this Bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any other Bidder or person, to submit a sham Bid or to refrain from Bidding, and has not, in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any other person, to fix the Bid price of the affiant or of any other Bidder, or to fix overhead, profit of affiant or said Bid price, or that of any other Bidder, or to secure any advantage against the Kayenta Township, and all statements in the attached Bid are true.

Project: Kayenta Bus Route Package

Location Kayenta, Arizona

_____
Signature

_____
Name and Title

_____
Date

NOTARY CERTIFICATION

Signed before me this _____day of _____,_____

_____
Notary Public
Commission
expires_____

CONTRACTOR QUESTIONNAIRE

Name and Title of Responsible Party_____

Taxpayer ID No. or Social Sec. No._____

D.B.A._____

STREET ADDRESS_____

CITY_____TELEPHONE_____

E-MAIL_____ FAX _____

STATE
LIC. NO._____TYPE_____

BANK
REFERENCES_____
_____
_____
_____

LIST THREE MOST RECENT CONSTRUCTION JOBS COMPLETED BY NAME AND ADDRESS, AND SHOW VALUE OF WORK, INCLUDING THE NAME AND LOCATION OF EACH PROJECT; THE VALUE OF THE WORK PERFORMED ON EACH; AND THE NAME, THE TITLE, AND TELEPHONE NUMBER OF THE CONTACT PERSON FOR EACH PROJECT:

_____
_____
_____
_____
_____
_____
_____

HOW LONG IN BUSINESS? _____

HOW MANY EMPLOYEES? _____

ARE YOU AN EQUAL OPPORTUNITY EMPLOYER?

YES_____ NO_____

HOW MANY EMPLOYEES ARE NATIVE AMERICAN?
_____

TOTAL NUMBER OF EMPLOYEES: _____

ARE YOU ELIGIBLE TO PERFORM GOVERNMENT WORK?

YES _____ NO _____

STATE_____ FEDERAL _____

TRIBAL_____

HAS ANY GOVERNMENT ENTITY EVER TAKEN AN ADVERSE ACTION AGAINST YOUR COMPANY AND/OR LICENSE HOLDER, BASED ON WORK PERFORMED?

YES _____NO_____

EXPLAIN CIRCUMSTANCES:
_____
_____
_____
_____
_____

NAME AND ADDRESS OF INSURANCE CARRIER

_____
_____
_____

Signature of Insurance Carrier:

By:_____
(Authorized Signature) (Date)

Name:_____

Title:_____

Exhibit F

To be used by those firms desiring to be qualified for Indian Preference.

INDIAN ENTERPRISES QUALIFICATION STATEMENT

NOTE: Submit complete questionnaire to the Indian Housing Authority within the time frame specified. Use additional sheets to complete answer if needed.

The Undersigned certifies under oath the truth and correctness of all answers to questions made hereinafter:

1. Applicant wishes to qualify as:

☐ An "Economic Enterprise" as defined in Section 3(3) of the Indian Financing Act of 1974 (P.L. 93-262); that is "any Indian-Owned… commercial, industrial or business activity established or organized for the purchase of profit: Provided, that such Indian owner-ship shall constitute not less than 51 percent of the enterprise:

☐ A "Tribal Organization" as defined in Section 4(c) of the Indian Self-Determination and Education Assistance Act (P.L. 93-638); that is: "the recognized governing body of any Indian Tribe; any legally established organization of Indians which is controlled, sanctioned or chartered by such governing body or which is democratically elected by the adult members of the Indian community to be served by such organization and which includes the maximum participation of Indians in all phases of its activities: Provided that in any case where a contract is let or grant made to an organization to perform services benefiting more than one Indian Tribe, the approval of each such Indian Tribe shall be a prerequisite to the letting or making of such contract or grant… "

2. Name of Enterprises or Organization: _____

   Address: _____

   _____

   Telephone No.: _____

3. Check One:

☐ Corporation ☐ Joint Venture

☐ Partnership ☐ Other

☐ Sole Proprietorship

4. Answer the following

If a Corporation:

a. Date of Incorporation: _____

b. State of Incorporation: _____

c. Give the names and addresses of the officers of this Corporation and establish whether they are Indian (I) or Non-Indian (NI).

NAME AND SOCIAL SECURITY	*I OR NI*	*TITLE*	*ADDRESS*	*% OF STOCK OWNERSHIP*
	I			
	NI			
	NI			
	NI			
	NI			
	NI			

d. Complete the following information on all stockholders who are not listed in C above, owning 0% or more of the stock. Establish whether they are Indian (I) or Non-Indian (NI).

NAME AND SOCIAL SECURITY	*I OR NI*	*ADDRESS*	*% OF STOCK OWNERSHIP*
	IN		
	NI		
	NI		
	NI		
	NI		

<u>If a Sole Proprietorship or Partnership</u>:

a. Date of Organization: _____

b. Give the following information on the individual or partners and establish whether they are Indian (I) or Non-Indian (NI).

NAME AND SOCIAL SECURITY	*I OR NI*	*ADDRESS*	*% OF STOCK OWNERSHIP*
	I		
	I		
	NI		
	NI		
	I		

If a Joint Venture:

a. Date of Joint Venture Agreement: _____

b. Attach the information of each member of the joint venture prepared in the appropriate format given above.

5. Give the name, address, and telephone number of the principal contact person of your organization: _____

_____

6. Has any officer or partner of your organization listed in #4 been an officer or partner of another organization that failed in the last ten (10) years to complete a contract? No

If yes, state circumstances:

_____

_____

_____

_____

_____

7. Has this enterprise failed in the last ten (10) years, to complete any work awarded to it or to complete the work on time? _____

If so, note when, where, and why: _____

_____

_____

_____

8. Will any officer or partner listed in #4 be engaged in outside employment?

☐ YES ☐ NO

If yes, complete:

NAME / TITLE	*HOURS PER WEEK OUTSIDE THE ENTERPRISE*

9. Is the enterprise or anyone listed in #4 above, currently subject to an administrative sanction issued by any department or agency of the Federal Government?

☐ YES ☐ NO

If yes, complete:

NAME OF PERSON/BUSINESS	*DATE OF ACTION*	*TYPE OF ACTION*	*DEPARTMENT OR AGENCY*

10. Does this enterprise have any subsidiaries or affiliates or is it a subsidiary or affiliate of another concern?

☐ YES ☐ NO

If yes, complete:

NAME AND ADDRESS OF SUBSIDIARY, AFFILIATE OR OTHER CONCERN	*DESCRIPTION OF RELATIONSHIP*

11. Does this enterprise or any person listed in #4 above have or intend to enter into any type of agreement with any other concern or person which relates to or affects the on-going administration, management or operations of this enterprise? These include but are not limited to management, and joint venture agreements and any arrangement or contract involving the provisions of such compensated services as administrative assistance, data processing, management consulting of all types, marketing, purchasing, production, and other type of compensated assistance.

☐ YES ☐ NO

If yes, attach a copy of any written agreement or an explanation of any oral or intended agreement.

12. Has this enterprise ever been subject to a judgment of any court or administrative sanction (Federal, State, or Tribal)?

☐ YES ☐ NO

Has any individual listed in #4 ever been subject to judgment of any court or administrative sanction (Federal, State, or Tribal)?

☐ YES ☐ NO

If the answer is yes to any question, furnish details in a separate attachment.

13. Has any tax lien or other collection procedure been instituted against this enterprise or the individuals listed in #4 as a sole proprietor or partner in their capacities with this enterprises or other enterprise?

☐ YES ☐ NO

If yes, furnish details in a separate exhibit.

14. Has this enterprise or any person listed in #4 ever been involved in a bankruptcy or insolvency proceeding? ☐ YES ☐ NO

If yes, furnish details in a separate exhibit.

15. What dollar amount of Working Capital is available to your enterprise prior to the start of construction? $_____

Explain the source of these funds: _____

_____

_____

Include a copy of the company's most recent audited financial statement.

16. How will project development bookkeeping and payroll be maintained (Check one):

a. By contract with an outside professional accounting firm: _____

Name: _____ Telephone No.: _____

Address: _____

b. ☐ Records are to be kept by enterprise personnel: If "b" has been checked, state the qualifications of your personnel to perform this function:

_____

_____

_____

_____

c. Other: _____

_____

_____

17. Trade References (including addresses and telephone numbers):

_____

_____

_____

_____

18. Bank and credit references (including addresses and telephone numbers):

_____

19. a. Indicate the core crew employees in your work force, their job titles, and whether they are Indian or Non-Indian. Core crew is defined as an individual who is a current bona-fide individual who is regularly employed by the contractor in a supervisory or other key position when work is available.

b. Over the past three (3) years, what has been the average number of employees:

20. Attach certification by a tribe or other evidence of enrollment in a federally recognized tribe for each officer, partner, or individual designated as an Indian in #4.

21. Attached a certified copy of the charter, article of incorporation, by-laws, partnership agreement, joint venture agreement and/or other pertinent organizational documentation.

22. Explain in narrative form the stock ownership, structure, management, control, financing, and salary or profit sharing arrangements of the enterprises, if not covered in answers to specific questions heretofore. Attached copies of all shareholder agreements, including voting trust, employment contracts, agreements between owners and enterprise. Include information on salaries, fees, profit sharing, material purchases, and equipment lease or purchase arrangements.

Evidence relating to structure, management, control, and financing should be specifically included. Also, list the specific management responsibilities of each principal, sole proprietor, partner, or party to a joint venture (as appropriate) list in response to #4.

23. Attach evidence that the enterprise (or an individual in it) is appropriately licensed for the type of work that is to be performed. Include Federal I.D. Number.

24. Attach a brief resume of the education, technical training, business, employment, and design and/or construction experience for each officer, partner, or sole proprietor listed in #4. Include references.

Exhibit F

NOTE:

I. Omission of any information may be caused for this statement not receiving timely and complete consideration.

II. Knowing that the Department of Housing and Urban Development must approve a contract between this enterprise and the Indian Housing Authority, the persons signing below certify that all information in this INDIAN ENTERPRISE QUALIFICATION STATEMENT, including exhibits and attachments, is true and correct.

III. Print and type name below all signatures.

If applicant is Sole Proprietor or LLC, Sign Below:

_____ _____

Name Date

If applicant is in a Partnership or Joint Venture, all Partners must sign below:

_____ _____

Name Date

_____ _____

Name Date

If applicant is a corporation, affix corporate seal

_____ _____

Corporate Seal Date

By: _____

President's Signature

Attested by: _____

Corporate Secretary's Signature

WARNING: U.S. Criminal Code, Section 1010, Title 18, U.S.C. provides in part: "Whoever… makes, passes, utters, or publishes any statement, knowing the same to be false… shall be fined not more than $5000 or imprisoned not more than two years, or both."

Issued August 1989

Exhibit G
Kayenta Bus Route
Quantity List - July 2017
Project No. 217-003

ARROWHEAD
ENGINEERING, INC.
1685 S. SAN TODARO PLACE
TUCSON, ARIZONA 85713
PHONE: (520) 822-7702
FAX: (520) 777-3438

#	Item	Qty	Unit	Unit Cost	Total
	Paving Notes				
1	Asphalt Pavement Section - 4" AC	11835	SY		
2	Asphalt Pavement Section - 8" ABC	11835	SY		
3	Vertical Curb and Gutter	7860	LF		
4	Sidewalk	4370	SY		
5	Curb Access Ramps	12	EA		
7	Curb Openings	18	EA		
	Subtotal:				
	Drainage Notes				
1	6" D50 Riprap	250	SY		
2	4'x6' Concrete Box Culvert	2	EA		
3	CMP Culvert Extension	50	LF		
4	CMP Dimpled Band	12	EA		
5	CMP End Sections	24	EA		
6	Diamond Plate Scupper	18	EA		
	Subtotal:				
	Striping and Signage Notes				
1	Stop Sign	5	EA		
2	School Crossing Sign - S1-1 with W16-7P	2	EA		
3	School Crossing Sign - S1-1 with W16-9P	2	EA		
4	School Crossing Pavement Markings	30	LF		
5	12" Stop Bar Paint	95	LF		
6	4" Yellow Center Line Pavement Markings	4100	LF		
7	4" White Lane Line Pavement Markings	8200	LF		
	Subtotal:				
	Earthwork				
1	Net Fill Import	14680	CY		
	Subtotal:				

Exhibit G
Kayenta Bus Route
Quantity List - July 2017
Project No. 217-003

ARROWHEAD
ENGINEERING, INC.
1685 S. SAN TODARO PLACE
TUCSON, ARIZONA 85713
PHONE: (520) 822-7702
FAX: (520) 777-3438

#	Item	Qty	Unit	Unit Cost	Total
	Pedstrian Path - Bid Alternative 2				
1	Pedestrian Path	95	LF		
	Subtotal:				
	Probably Cost Supplement				
1	Mobilization	1	LS		
2	Traffic Control	1	LS		
3	Testing/QAQC	1	LS		
4	SWPPP	1	LS		
5	Landscape	1	LS		
7	State Transaction Privilege	1	LS		
	Subtotal:				
	Cost Subtotal:				
	Builder's Risk Insurance				
	Liability Insurance				
	Payment and Performance Bond				
	10% Contingency				
				SUBTOTAL	
	Kayenta Sales + Construction Tax				
	6% Total				
	Job Total				

Arrowhead Engineering Inc. is pleased to provide the following feasibility cost estimate for the Kayenta Bus Route. The scope of work included in this estimate is for the general sitework items typically performed (grading, sewer, water, joint utilities, paving and drainage). Although we have tried to provide an accurate cost for construction, this estimate is based on several assumptions and is no way intended to represent the actual estimate characterized by the final approved design plansets. Early cost estimates usually contain a larger degree of uncertainty. A 10% contingency is added as a provision for unforeseeable elements of cost within the defined project scope. As such the user of these documents shall not hold Arrowhead Engineering Inc. liable for any errors or omissions associated with these documents.

END OF INSTRUCTIONS FOR BIDDERS

PART 2:
SPECIFICATIONS

SECTION A:
SPECIAL PROVISIONS

SPECIAL PROVISIONS

1. Project Scheduling and Completion Time:

Work on this project shall be completed within the time specified in the contract, beginning with the day specified in the "Notice to Proceed with Construction."
The Contractor shall not receive any additional time due to the late arrival of equipment or materials.
No work shall be done by the Contactor on Saturdays, Sundays, holidays or weekday overtime without prior written approval of the Engineer and prior written agreement to reimburse the Engineer for all overtime expenses the Engineer or any subconsultant incurs. These expenses will be billed directly to the Contractor by the Engineer. The Contractor will be liable for liquidated damages as set forth in the contract documents. The Contractor expressly agrees to the terms of these clauses.

2. Construction Office and Laboratory:

The contractor is not required to maintain an office onsite. However, the Contractor's onsite superintendent shall be accessible by telephone to the Engineer during the hours of 6:00 a.m. to 6:00 p.m. There is no separate pay for fulfilling this requirement.

3. Water:

The Contractor shall make provisions for whatever water may be required for construction activity. Before this source of water is used, the Contractor shall determine the quality and suitability of the water for use in construction.
There is no separate pay for this item.

4. Quality Control Testing/Sampling and Construction Staking:

The Contractor shall be responsible for all quality control testing/sampling, retesting and construction staking.

5. Access to Documents:

The duly authorized representatives of the Owner and the Engineer shall have access to any books, documents, papers and records of the Contractor which are in any way pertinent to the contract for the purpose of making audit, examination, excerpts and transcriptions.

6. Project Sign:

A Project sign is required at beginning of project indicated on plans.

7. Performance Bond:

The Contractor agrees to furnish a performance bond for 100 percent of the contract price. Th.is performance bond is one that is executed in connection with a contract to assure payment as required by law of all persons supplying labor and material in the execution of the work provided for in the contract.

8. Plans and Specifications:

All construction shall be in accordance with Plans and Specifications except as noted on the plans or contract documents. If discrepancies arise the Engineer's field representative will resolve the differences and his decision will be final.

9. Storm Water Pollution Prevention Plans:

The Contractor shall fulfill and implement the Storm Water Pollution Prevention Plans as instructed in the Specification Book or noted in the Construction Plan Sheets. **There is no**

separate pay item for this and is incidental to this project.

10. Air and Water Quality:

The Contractor shall incorporate the following actions into his construction methods to minimize air and water pollution during construction.

A. Site Preparation

- Minimize land disturbance
- Use watering trucks to minimize dust
- Cover trucks when hauling dirt
- Stabilize the surface of dirt piles if not removed immediately
- Grade to prevent soil from washing onto paved roadways

B. Construction

- Cover trucks when transferring materials
- Use dust suppressants on traveled paths which are not paved
- Minimize unnecessary vehicular and machinery activities
- Minimize dirt track-out by washing or cleaning trucks before leaving the construction site
- Remove unused material
- Remove dirt piles

Portable sources of air pollution such as rock, sand, gravel, and Asphaltic concrete plants are required to receive installation and operating permits from the Arizona Department of Environmental Quality, and/or the Navajo Nation EPA Office in order to operate on this project.

11. Existing Archaeological Sites and Cultural/Historical Artifacts:

In the event that cultural or historical artifacts are discovered during construction, the Contractor shall cease all work immediately and contact the Engineer or the Owner.

12. Protection of Existing Facilities:

The Contractor shall be responsible for protecting all existing facilities and roads, except those called for removal. He shall completely restore all existing facilities damaged by his or his subcontractors' work crews to their preconstruction condition. This repair and restoration is a non-pay item.

13. Mobilization:

Mobilization shall consist of preparatory work and operations, including but not limited to, the movement of personnel, equipment, supplies and incidentals to the project site; the establishment of all facilities necessary for work on the project.

14. Storage of Materials and Equipment:

Equipment and material can be stored in a staging area on the property. The Contractor must locate the staging area with the cooperation and agreement of the Owner and the Engineer. The Contractor is responsible for securing the staging area and its contents. The Contractor shall restore the staging area to its original or proposed condition at his expense, as necessary.

15. Permits:

The Contractor shall be responsible for acquiring all permits for performing the work, including but not limited to a Water Use Permit, Air Quality Permit (for Hot Mix Plant). There is no separate pay for the cost of the permits.

16. Bid Items:

The aggregate of the bid items listed are intended to represent the "complete working systems" as indicated on the construction drawings and in the Specifications for this project. The “complete working systems" includes all mobilization, equipment, materials, fabrication, transportation, installation, connections, supplies, labor, taxes, overhead and profit, permitting, testing, acceptance and incidentals necessary to construct the systems shown and described on the plans and in the specifications. By bidding the project, the Contractor acknowledges that he has included all costs necessary to construct these working systems as shown on the plans and described in the Specifications.

17. Security:

Each site is not a secure site. Vandalism can and does occur. The Contractor will take measures necessary to protect equipment, materials, and supplies and "the Work" from vandals during the course of the construction through final inspection and acceptance.

18. Pre-Construction Conferences:

The contractor will be expected to attend one (1) Pre-Construction Conference at the project site, or a location to be specified to the Owner. The first Conference will be convened soon after contract award.

SECTION B:
GENERAL CONDITIONS

GENERAL CONDITIONS

1. DEFINITIONS:

1.1 Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

1.2 ADDENDA- Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the CONTRACT DOCUMENTS, DRAWINGS and SPECIFICATIONS, by additions, deletions, clarifications or corrections.

1.3 BID - The offer or proposal of the BIDDER submitted on the prescribed form setting forth the prices for the WORK to be performed.

1.4 BIDDER - Any person, firm or corporation submitting a BID for the WORK.

1.5 BONDS - Bid, Performance, and Payment Bonds and other instruments of security, furnished by the CONTRACTOR and his surety in accordance with the CONTRACT DOCUMENTS.

1.6 CHANGE ORDER -A written order to the CONTRACTOR authorizing an addition, deletion or revision in the WORK within the general scope of the CONTRACT DOCUMENTS, or authorizing an adjustment in the CONTRACT PRICE or CONTRACT TIME.

1.7 CONTRACT DOCUMENTS - The contract, including Advertisement For Bids, Information For Bidders, BID, Bid Bond, Agreement, Payment Bond, Performance Bond, NOTICE OF AWARD, NOTICE TO PROCEED, CHANGE ORDER, DRAWINGS, SPECIFICATIONS, and ADDENDA.

1.8 CONTRACT PRICE - The total monies payable to the CONTRACTOR under the terms and conditions of the CONTRACT DOCUMENTS.

1.9 CONTRACT TIME - The number of working days stated in the CONTRACT DOCUMENTS for the completion of the WORK.

1.10 CONTRACTOR - The person, firm or corporation with whom the OWNER has executed the Agreement. Except as otherwise noted herein, CONTRACTOR shall also include Subcontractors.

1.11 DRAWINGS - The part of the CONTRACT DOCUMENTS which show the characteristics and scope of the WORK to be performed and which have been prepared or approved by the ENGINEER.

1.12 ENGINEER - The person, firm or corporation named as such in the CONTRACT DOCUMENTS.

1.13 F1ELD ORDER- A written order effecting a change in the WORK not

involving an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, issued by the ENGINEER to the CONTRACTOR during construction.

1.14 NOTICE OF AWARD - The written notice of the acceptance of the BID from the OWNER to the successful BIDDER.

1.15 NOTICE TO PROCEED - Written communication issued by the OWNER to the CONTRACTOR authorizing him to proceed with the WORK and establishing the date of commencement of the WORK.

1.16 OWNER- A public or quasi-public body or authority, corporation, association, partnership, or individual for whom the WORK is to be performed.

1.17 PROJECT - The undertaking to be performed as provided in the CONTRACT DOCUMENTS.

1.18 RESIDENT PROJECT REPRESENTATIVE - The authorized representative of the OWNER who is assigned to the PROJECT site or any part thereof.

1.19 SHOP DRAWINGS - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the CONTRACTOR, a SUBCONTRACTOR, manufacturer, SUPPLIER or distributor, which illustrate how specific portions of the WORK shall *be* fabricated or installed.

1.20 SPECIFICATIONS -A part of the CONTRACT DOCUMENTS consisting of written description of a technical nature of materials, equipment, construction systems, standards and workmanship.

1.21 SUBCONTRACTOR - An individual, firm or corporation having a direct contract with the CONTRACTOR or with any other SUBCONTRACTOR for the performance of a part of the WORK at the site.

1.22 SUBSTANTIAL COMPLETION - That date as certified by the ENGINEER when the construction of the PROJECT or a specified part thereof is sufficiently completed, in accordance with the CONTRACT DOCUMENTS, so that the PROJECT or specified part can be utilized for the purposes for which it is intended.

1.23 SUPPLEMENTAL GENERAL CONDITIONS - Modifications to General Conditions required by a Federal agency for participation in the PROJECT and approved by the agency in writing prior to inclusion in the CONTRACT DOCUMENTS, or such requirements that may be imposed by applicable state laws.

1.24 SUPPLIER - Any person or organization who supplies materials or equipment for the WORK, including that fabricated to a special design, but who does not perform labor at the site.

1.25 WORK - All labor necessary to produce the construction required by the CONTRACT DOCUMENTS, and all materials and equipment incorporated or to be incorporated in the PROJECT.

1.26 WORKING DAY - A working day is a Monday, Tuesday, Wednesday,

Thursday, or Friday (excluding holidays) during which work is conducted for a consecutive eight hour period.

1.27 WRITTEN NOTICE - Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party of his authorized representative on the WORK.

2. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

2.1 The CONTRACTOR may be furnished additional instructions and detail drawings, by the ENGINEER, as necessary to carry out the WORK required by1he CONTRACT DOCUMENTS.

2.2 The additional drawings and instruction thus supplied will become a part of the CONTRACT DOCUMENTS. The CONTRACTOR shall carry out the WORK in accordance with the additional detail drawings and instructions.

3. SCHEDULES, REPORTS AND RECORDS

3.1 The CONTRACTOR shall submit to the OWNER such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the CONTRACT DOCUMENTS for the WORK to be performed.

3.2 Prior to the beginning of work, the CONTRACTOR shall submit construction progress schedules showing the order in which he proposes to carry on the WORK, including dates at which he will start the various parts of the WORK, estimated date of completion of each part and, as applicable:

the dates at which special detail drawings will be required and respective dates for submission of SHOP DRAWINGS, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

3.3 The CONTRACTOR shall also submit a schedule of payments that he anticipates he will earn during the course of the WORK.

4. DRAWINGS AND SPECIFICATIONS

4.1 The intent of the DRAWINGS and SPECIFICATIONS is that the CONTRACTOR shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the WORK in accordance with the CONTRACT DOCUMENTS and all incidental work necessary to complete the PROJECT in an acceptable manner, ready for use, occupancy or operation by the OWNER.

4.2 In case of conflict between the DRAWINGS and SPECIFICATIONS, the SPECIFICATIONS shall govern. Figure dimensions on DRAWINGS shall govern over scale dimensions, and detailed DRAWINGS shall govern over general DRAWINGS.

4.3 Any discrepancies found between the DRAWINGS and SPECIFICATIONS and site conditions or any inconsistencies or ambiguities in the DRAWINGS or SPECIFICATIONS shall be immediately reported to the ENGINEER, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. WORK done by the CONTRACTOR after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the CONTRACTOR'S risk.

5. SHOP DRAWINGS

5.1 After checking and verifying all field measurements and after complying with applicable procedures specified in the General Conditions, CONTRACTOR shall submit to ENGINEER for review and approval five copies of all SHOP DRAWINGS, which will bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR'S responsibilities under the CONTRACT DOCUMENTS with respect to the review of the submission. All submissions will be identified as ENGINEER may require. The data shown on the SHOP DRAWINGS will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable ENGINEER to review the information as required.

5.2 CONTRACTOR shall also submit to ENGINEER for review and approval with such promptness as to cause no delay in WORK, all samples required by the CONTRACT DOCUMENTS. All samples will have been checked by and accompanied by a specific written indication that CONTRACTOR has satisfied CONTRACTOR'S responsibilities under the CONTRACT DOCUMENTS with respect to the review of the submission and will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended.

5.3 Before submission of each SHOP DRAWING or sample CONTRACTOR shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each SHOP DRAWING or sample with other SHOP DRAWINGS and samples and with the requirements of the WORK and the CONTRACT DOCUMENTS.

5.3.1 At the time of each submission, CONTRACTOR shall give ENGINEER specific written notice of each variation that the SHOP DRAWINGS or samples may have from the requirements of the CONTRACT DOCUMENTS, and, in addition, shall cause a specific notation to be made on each SHOP DRAWING submitted to ENGINEER for review and approval of each such variation.

5.4 ENGINEER will review and approve with reasonable promptness SHOP DRAWINGS and samples, but ENGINEER's review and approval will be only for conformance with the design concept of the PROJECT and for compliance with the information given in the CONTRACT DOCUMENTS and shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the CONTRACT DOCUMF.NTS) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

CONTRACTOR shall make corrections required by ENGINEER, and shall return the required number of corrected copies of SHOP DRAWINGS and submit as required new samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

5.5 ENGINEER's review and approval of SHOP DRAWINGS or samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the CONTRACT DOCUMENTS unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of submission as required by paragraph 5.3.1 and ENGINEER has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the SHOP DRAWING or sample approval; nor will any approval by ENGINEER relieve CONTRACI'OR from responsibility for errors or omissions in the SHOP DRAWINGS or from responsibility for having complied with the provisions of paragraph 5.3.

5.6 Where a SHOP DRAWING or sample is required by the Specifications, any related WORK performed prior to ENGINEER's review and approval of the pertinent submission will be the sole expense and responsibility of CONTRACTOR.

6. MATERIALS, SERVICES AND FACILITIES

6.1 It is understood that, except as otherwise specifically stated in the CONTRACT DOCUMENTS, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, light, power, and all other services and facilities of any nature whatsoever necessary to execute, complete and deliver the WORK within the specified time. The CONTRACTOR may contact the OWNER's Public Works Director or Engineer concerning a location and charges for water.

6.2 Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the WORK. Stored materials and equipment to be incorporated in the WORK shall be located so as to facilitate prompt inspection.

6.3 Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

6.4 Materials, supplies and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.

6.5 Materials, supplies or equipment to be incorporated into the WORK shall not be purchased by the CONTRACTOR or the SUBCONTRACTOR subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

7. INSPECTION AND TESTING

7.1 All materials and equipment used in the construction of the PROJECT shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the CONTRACT DOCUMENTS.

7.2 The OWNER shall provide inspection and testing services required by the CONTRACT DOCUMENTS.

7.3 The CONTRACTOR shall provide at his expense the testing and inspection services not required by the CONTRACT DOCUMENTS.

7.4 If the CONTRACT DOCUMENTS, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any WORK to specifically be inspected, tested, or approved by someone other than the CONTRACTOR, the CONTRACTOR will give the ENGINEER timely notice of readiness. The CONTRACTOR will then furnish the ENGINEER the required certificates of inspection, testing or approval.

7.5 Inspections, tests or approvals by the ENGINEER or others shall not relieve the CONTRACTOR from his obligations to perform the WORK in accordance with the requirements of the CONTRACT DOCUMENTS.

7.6 The ENGINEER and his representatives will at all times have access to the WORK. In addition, authorized representatives and agents of any participating Federal or state agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The CONTRACTOR will provide proper facilities for such access and observation of the WORK and also for any inspection, or testing thereof.

7.7 If any WORK is covered contrary to the written instructions of the ENGINEER it must, if requested by the ENGINEER, be uncovered for his observation and replaced at the CONTRACTOR'S expense.

7.8 If the ENGINEER considers it necessary or advisable that covered WORK be inspected or tested by others, the CONTRACTOR, at the ENGINEER'S request, will uncover, expose or otherwise make available for observation, inspection or testing as the ENGINEER may require, that portion of the WORK in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such WORK is defective, the CONTRACTOR will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If however, such WORK is not found to be defective, the CONTRACTOR will be allowed an increase in the CONTRACT PRICE at the bid unit cost for such items or an extension of the CONTRACT TIME, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate CHANGE ORDER shall be issued.

8. SUBSTITUTIONS

8.1 Whenever a material, article or piece of equipment is identified on the DRAWINGS or SPECIFICATIONS by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The CONTRACTOR may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the CONTRACT DOCUMENTS by reference to brand name or catalogue number, and if, in the opinion of the

ENGINEER, such material, article, or piece of equipment is of equal substance and function to that specified, the ENGINEER may approve its substitution and use by the CONTRACTOR. Ally cost differential shall be deductible from the CONTRACT PRICE and the CONTRACT DOCUMENTS shall be appropriately modified by CHANGE ORDER. The CONTRACTOR warrants that if substitutes are approved, no major changes in the function or general design of the PROJECT will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the CONTRACTOR without a change in the CONTRACT PRICE or CONTRACT TIME.

9. PATENTS

9.1 The CONTRACTOR shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and save the OWNER harmless from loss on account thereof, except that the OWNER shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer or manufacturers is specified; however, if the CONTRACTOR has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the ENGINEER.

10. SURVEYS, PERMITS, REGULATIONS

10.1 The ENGINEER shall furnish surveys and staking required for control only as indicated on the construction plans. The CONTRACTOR shall supply any additional staking required that is not otherwise specified to be provided by the ENGINEER.

10.2 The CONTRACTOR shall carefully preserve bench marks, reference points and stakes and, in case of willful or carless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

10.3 Permits and licenses of a temporary nature necessary for the prosecution of the WORK shall be secured and paid for by the CONTRACTOR unless otherwise stated in the SUPPLEMENTAL GENERAL CONDITIONS. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the OWNER, unless otherwise specified. The CONTRACTOR shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the WORK as drawn and specified. If the CONTRACTOR observes that the CONTRACT DOCUMENTS are at variance therewith, he shall promptly notify the ENGINEER in writing, and any necessary changes shall be adjusted as provided in Section 13, CHANGES IN THE WORK.

11. PROTECTION OF WORK, PROPERTY AND PERSONS

11.1 The CONTRACTOR will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the WORK. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the WORK and other persons who may be affected thereby, all the WORK and all materials or

equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

11.2 The CONTRACTOR will comply with all applicable law, ordinances, rules, regulations and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the WORK, all necessary safeguards for safety and protection. He will notify owners of adjacent utilities when prosecution of the WORK may affect them. The CONTRACTOR will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the CONTRACTOR, any SUBCONTRACTOR or anyone directly or indirectly employed by any of them or anyone whose acts any of them be liable, except damage or loss attributable to the fault of the CONTRACT DOCUMENTS or to the acts or omissions of the OWNER or the ENGINEER or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the CONTRACTOR.

11.3 In emergencies affecting the safety of persons or the WORK or property at the site or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the ENGINEER or OWNER, shall act to prevent threatened damage, injury or loss. He will give the ENGINEER prompt WRITTEN NOTICE of any significant changes in the WORK or deviations from the CONTRACT DOCUMENTS caused thereby, and a CHANGE ORDER shall thereupon be issued covering the changes and deviations involved.

12. SUPERVISION BY CONTRACTOR

12.1 The CONTRACTOR will supervise and direct the WORK. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The CONTRACTOR will employ and maintain on the WORK, at all times, a qualified supervisor or superintendent who shall have been designated in writing by the CONTRACTOR as the CONTRACTOR'S representative at the site. The supervisor shall have full authority to act on behalf of the CONTRACTOR and all communications given to the supervisor shall be as binding as if given to the CONTRACTOR. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the WORK.

13. CHANGES IN THE WORK

13.1 The OWNER may at any time, as the need arises, order changes within the scope of the WORK without invalidating the Agreement. If such changes increase or decrease the amount due under the CONTRACT DOCUMENTS, or in the time requirement for performance of the WORK, an equitable adjustment shall be authorized by a CHANGE ORDER based on the unit bid prices.

13.2 The ENGINEER, also, may at any time, by issuing a FIELD ORDER, make changes in the details of the WORK. The CONTRACTOR shall proceed with the performance of any changes in the WORK so ordered by the ENGINEER unless the CONTRACTOR believes that such FIELD ORDER entitles him to a change in the CONTRACT PRICE at the unit bid prices or TIME or both, in which event he shall give the ENGINEER WRITTEN NOTICE thereof within seven (7) calendar days after the receipt of the ordered change. Thereafter the CONTRACTOR shall document the basis for the change in CONTRACT PRICE or TIME within thirty (30) days. The CONTRACTOR shall not execute such changes pending receipt of an executed CHANGE ORDER or further instruction from the OWNER.

13.3 Before any work covered by a change order is commenced, said order must be approved in writing by the OWNER. Any work performed prior to issuance of an approved change order will be at the CONTRACTOR’S risk.

13.4 Estimated quantities may be adjusted (up or down) twenty-five percent (25%) without a change in the contract unit price.

13.5 Force account work shall be covered by a written change order.

14. CHANGES IN THE CONTRACT PRICE

14.1 The CONTRACT PRICE may be changed only by a CHANGE ORDER. The value of any WORK covered by a CHANGE ORDER or of a claim for increase or decrease in the CONTRACT PRICE shall be determined by one or more of the following methods in the order of precedence listed below:

(a) Unit prices previously approved.
(b) An agreed lump sum.

15. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

15.1 The date of beginning and the time for completion of the WORK are essential conditions of the CONTRACT DOCUMENTS and the WORK embraced shall be commenced on a date specified in the NOTICE TO PROCEED.

15.2 The CONTRACTOR will proceed with the WORK at such rate of progress to insure full completion within the CONTRACT TIME. It is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the CONTRACT TIME for the completion of the WORK described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the WORK. Extensions of contract time under this paragraph shall be allowed only for unforeseen weather conditions.

15.3 If the CONTRACTOR shall rail to complete the WORK within the CONTRACT TIME, or extension of time granted by the OWNER, then the CONTRACTOR will pay to the OWNER the amount for liquidated damages as specified in the CONTRACT for each calendar day that the CONTRACTOR shall be in default after the time stipulated in the CONTRACT DOCUMENTS.

15.4 The CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the WORK is due to the following, and the CONTRACTOR has promptly given WRITTEN NOTICE within seven (7) calendar days of such delay to the OWNER or ENGINEER.

15.4.1 To any preference, priority or allocation order duly issued by the OWNER.

15.4.2 To unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and

15.4.3 To any delays of SUBCONTRACTORS occasioned by any of the causes specified in paragraphs 15.4.l and 15.4.2 of this article.

16. CORRECTION OF WORK

16.1 The CONTRACTOR shall promptly remove from the premises all WORK rejected by the ENGINEER for failure to comply with the CONTRACT DOCUMENTS, whether incorporated in the construction or not, and the CONTRACTOR shall promptly replace and re-execute the WORK in accordance with the CONTRACT DOCUMENTS and without expense to the OWNER and shall bear the expense of making good all WORK of other CONTRACTORS destroyed or damaged by such removal or replacement.

16.2 All removal and replacement WORK shall be done at the CONTRACTOR'S expense. If the CONTRACTOR does not take action to remove such rejected WORK within 10 (ten) days after receipt of WRITTEN NOTICE, the OWNER may remove such WORK and store the materials at the expense of the CONTRACTOR.

17. SUBSURFACE CONDITIONS

17.1 The CONTRACTOR shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the OWNER by WRITTEN NOTICE of:

17.1.1 Subsurface or latent physical conditions at the site differing materially from those indicated in the
CONTRACT DOCUMENTS; or

17.1.2 Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in WORK of the character provided for in the CONTRACT DOCUMENTS.

17.2 The OWNER shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the WORK, an equitable adjustment shall be made and the CONTRACT DOCUMENTS shall be modified by a CHANGE ORDER. Any claim of the CONTRACTOR for adjustment hereunder shall not be allowed unless he has given the required WRITTEN NOTICE; provided that the OWNER may, if he determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

18. SUSPENSION OF WORK, TERMINATION AND DELAY

18.1 The OWNER may suspend the WORK or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the CONTRACTOR, by WRITTEN NOTICE to the CONTRACTOR and the ENGINEER which notice shall fix the date on which WORK shall be resumed. The CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to any suspension.

18.2 If the CONTRACTOR is adjudged a bankruptor, insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or

receiver is appointed for the CONTRACTOR or for any of his property, or if he files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workmen or unsuitable materials or equipment, or if he repeatedly fails to make prompt payments to SUBCONTRACTORS or for labor, materials or equipment or if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the WORK or if he disregards the authority of the ENGINEER, or if he otherwise violates any provision of the CONTRACT DOCUMENTS, then the OWNER may, without prejudice to any other right or remedy and after giving the CONTRACTOR and his surety a minimum of ten (I0) days from delivery of a WRITTEN NOTICE, terminate the services of the CONTRACTOR and take possession of the PROJECT and of all materials, equipment, tools, construction equipment and machinery thereon owned by the CONTRACTOR, and finish the WORK by whatever method he may deem expedient. In such case the CONTRACTOR shall not be entitled to receive any further payment until the WORK is finished. If the unpaid balance of the CONTRACT PRICE exceeds the direct and indirect costs of completing the PROJECT, including compensation for additional professional services, such excess shall be paid to the CONTRACTOR. If such costs exceed such unpaid balance, the CONTRACTOR will pay the difference to the OWNER. Such costs incurred by the OWNER will be determined by the ENGINEER and incorporated in a CHANGE ORDER.

18.3 Where the CONTRACTOR'S services have been so terminated by the OWNER, said termination shall not affect any right of the OWNER against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies by the OWNER due the CONTRACTOR will not release the CONTRACTOR from compliance with the CONTRACT DOCUMENTS.

18.4 After ten (10) days from delivery of a WRITTEN NOTICE to the CONTRACTOR and the ENGINEER, the OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the PROJECT and terminate the Contract. In such case, the CONTRACTOR shall be paid for all WORK executed and any expense sustained plus reasonable profit.

18.5 If, through no act or fault of the CONTRACTOR, the WORK is suspended for a period of more than ninety (90) days by the OWNER or under an order of court or other public authority, or the ENGINEER fails to act on any request for payment within thirty (30) days after it is submitted, or the OWNER fails to pay the CONTRACTOR substantially the sum approved by the ENGINEER or awarded by arbitrators within thirty (30) days of its approval and presentation, then the CONTRACTOR may, after ten (IO) days from delivery of a WRITTEN NOTICE to the OWNER and the ENGINEER, terminate the CONTRACT and recover from the OWNER payment for all WORK executed and all expenses sustained. In addition and in lieu of terminating the CONTRACT, if the ENGINEER has failed to act on a request for payment or if the OWNER has failed to make any payment as aforesaid, the CONTRACTOR may upon ten (10) days written notice to the OWNER and the ENGINEER stop the WORK until he has been paid all amounts then due, in which event and upon resumption of the

WORK, CHANGE ORDERS shall be issued for adjusting the CONTRACT PRICE or extending the CONTRACT TIME or both to compensate for the costs and delays attributable to the stoppage of the WORK.

18.6 If the performance of all or any portion of the WORK is suspended, delayed, or interrupted as a result of a failure of the OWNER or ENGINEER to act within the time specified in the CONTRACT DOCUMENTS, or if no time is specified, within a reasonable time, an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, shall be made by CHANGE ORDER to compensate the CONTRACTOR for the costs and delays necessarily caused by the failure of the OWNER or ENGINEER.

19. PAYMENTS TO CONTRACTOR

At least ten (10) days before each progress payment falls due (but not more often than once a month), the CONTRACTOR will submit to the ENGINEER an invoice filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by the invoice and supported by such data as the ENGINEER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the WORK but delivered and suitably stored at or near the site, the invoice shall also be accompanied by such supporting data, satisfactory to the OWNER, as will establish the OWNER'S title to the material and equipment and protect his interest therein, including applicable insurance. The ENGINEER will, within ten (l0) days after receipt of each invoice, either indicate in writing his approval of payment and present the invoice to the OWNER, or return the invoice to the CONTRACTOR indicating in writing his reasons for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary correction and resubmit the invoice. Prior to payment, the OWNER must approve the invoice. The OWNER will, within thirty (30) days of presentation of an approved invoice, pay the CONTRACTOR a progress payment on the basis of the approved invoice. The OWNER shall retain ten (10%) percent of the amount of each payment until final completion and acceptance of all work covered by the CONTRACT DOCUMENTS. On completion and acceptance of a part of the WORK on which the price is stated separately in the CONTRACT DOCUMENTS, payment may be made in full, including retained percentages, less authorized deductions.

19.1 The request for payment may also include an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site.

19.2 Prior to SUBSTANTIAL COMPLETION, the OWNER, with the approval of the ENGINEER and with the concurrence of the CONTRACTOR, may use any completed or substantially completed portions of the WORK. Such use shall not constitute an acceptance of such portions of the WORK.

19.4 The OWNER shall have the right to enter the premises for the purpose of doing work not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care

and protection of the WORK, or the restoration of any damaged WORK except such as may be caused by agents or employees of the OWNER.

19.5 The CONTRACTOR shall provide with his final pay report a final DBE participation certification. No final payment will be made without the completed certification.

19.6 Upon completion and acceptance of the WORK, the ENGINEER shall issue a letter attached to the final payment request that the WORK has been accepted by him under the conditions of the CONTRACT DOCUMENTS. The entire balance found to be due the CONTRACTOR, including the retained percentages, but except such sums as may be lawfully retained by the OWNER, shall be paid to the CONTRACTOR within thirty (30) days of completion and acceptance of the WORK.

19.7 The CONTRACTOR will indemnify and save the OWNER or the OWNER'S agents harmless from all claims growing out of the lawful demands of SUBCONTRACTORS, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the WORK. The CONTRACTOR shall, at the OWNER'S request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the CONTRACTOR fails to do so the OWNER may, after having notified the CONTRACTOR, either pay unpaid bills or withhold from the CONTRACTOR'S unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the CONTRACTOR shall be resumed, in accordance with the terms of the CONTRACT DOCUMENTS, but in no event shall the provisions of this sentence be construed to impose any obligations upon the OWNER to either CONTRACTOR, his Surety, or any third party. In paying any unpaid bills of the CONTRACTOR, any payment so made by the OWNER shall be considered as a payment made under the CONTRACT DOCUMENTS by the OWNER to the CONTRACTOR and the OWNER shall not be liable to the CONTRACTOR for such payments made in good faith.

19.8 If the OWNER fails to make payment 30 days after approval by the ENGINEER, in addition to other remedies available to the CONTRACTOR, there shall be added to each such payment interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the CONTRACTOR.

20. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

20.1 The acceptance by the CONTRACTOR of final payment shall be and shall operate as a release to the OWNER of all claims and all liability to the CONTRACTOR other than claims in stated amounts as may be specifically excepted by the CONTRACTOR for all things done or furnished in connection with this WORK and for every act and neglect of the OWNER and other relating to or arising out of this WORK. Any payment, however, final or otherwise, shall not

release the CONTRACTOR or his sureties from any obligations under the CONTRACT DOCUMENTS or the Performance Bond and Payment Bonds.

21. INSURANCE

21.1 The CONTRACTOR shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of or result from the CONTRACTOR'S execution of the WORK, whether such execution be by himself or by any SUBCONTRACTOR or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

21.1.1 Claims under workmen's compensation, disability benefit and other similar employee benefit acts;

21.1.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees;

21.1.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;

21.1.4 Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the CONTRACTOR, or (2) by any other person; and

21.1.5 Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

21.2 Certificates of Insurance acceptable to the OWNER shall be filed with the OWNER with the delivery of the executed contracts. These Certificates shall contain a provision that coverages afforded under the policies will not be canceled unless at least fifteen (15) days prior WRITTEN NOTICE has been given to the OWNER.

21.3 The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, liability insurance as hereinafter specified;

21.3.1 CONTRACTOR'S General Public Liability and Property Damage Insurance including vehicle coverage issued to the CONTRACTOR and protecting him from all claims for personal injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with any operations under the CONTRACT DOCUMENTS, whether such operations be by himself or by any SUBCONTRACTOR under him, or anyone directly or indirectly employed by the CONTRACTOR or by a SUBCONTRACTOR under him. Insurance shall be written with a limit of liability of not less than $1,000,000 for all damages arising out of bodily injury, including death, at any time resulting therefrom sustained by any one person in any one accident; and a limit of liability of not less than $1,000,000 aggregate for any such damages sustained by two or more persons in

any one accident. Insurance shall be written with a limit of liability of not less than $1,000,000 for all property damage sustained by any one person in any one accident; and a limit of liability of not less than $1,000,000 aggregate for any such damage sustained by two or more persons in any one accident.

21.3.2 The CONTRACTOR shall acquire and maintain, if applicable, Fire and Extended Coverage insurance upon the PROJECT to the full insurable value thereof for the benefit of the OWNER, the CONTRACTOR, and SUBCONTRACTORS as their interest may appear. This provision shall in no way release the CONTRACTOR or CONTRACTOR'S surety from obligations under the CONTRACT DOCUMENTS to fully complete the PROJECT.

21.4 The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, in accordance with lite provisions of the laws of the state in which the work is Compensation Insurance, including occupational disease provisions for all of his employees at the site of the PROJECT and in case any work is sublet, the CONTRACTOR shall require such SUBCONTRACTOR similarly to provide Workmen's Compensation Insurance, including occupational disease provisions for all lite latter's employees unless such employees are covered by the protection afforded by the CONTRACTOR. In case any class of employees engaged in hazardous work under this contract at the site of the PROJECT is not protected under Workmen's Compensation statute, the CONTRACTOR shall provide, and shall cause each SUBCONTRACTOR to provide, adequate and suitable insurance for the protection of his employees not otherwise protected.

21.5 The CONTRACTOR shall secure, if applicable, "All Risk" type Builder's Risk Insurance for WORK to be performed. Unless specifically authorized by the OWNER, the amount of such insurance shall not be less than the CONTRACT PRICE totaled in the BID. The policy shall cover not less than the losses due to fire, explosion, hail, lightning, vandalism, malicious mischief, wind, collapse, riot, aircraft, and smoke during the CONTRACT TIME, and until the WORK is accepted by the OWNER. The policy shall name as the insured the CONTRACTOR, the ENGINEER, and the OWNER.

22. CONTRACT SECURITY

22.1 The CONTRACTOR shall within ten (10) days after the receipt of the NOTICE OF AWARD furnish the OWNER with a Performance Bond and a Payment Bond in penal sums equal to the amount of the CONTRACT PRICE, conditioned upon the performance by the CONTRACTOR of all undertakings, covenants, terms, conditions and agreements of the CONTRACT DOCUMENTS, and upon the prompt payment by the CONTRACTOR to all persons supplying labor and materials in the prosecution of the WORK provided by the CONTRACT DOCUMENTS. Such BONDS shall be executed by the CONTRACTOR and a corporate bonding company licensed to transact such business in the state in which the WORK is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in

the Treasury Department Circular Number 570. The expense of these BONDS shall be borne by the CONTRACTOR. If at any time a surety on any such BOND is declared bankrupt or loses its right to do business in the state in which the WORK is to be performed or is removed from the list of Surety Companies accepted on Federal BONDS, CONTRACTOR shall within ten (10) days after notice from the OWNER to do so, substitute an acceptable BOND (or BONDS) in such form and sum and signed by such other surety or sureties as may be satisfactory to the OWNER. The premiums on such BOND shall be paid by the CONTRACTOR No further payments shall be deemed due nor shall they be made until the new surety or sureties have furnished an acceptable BOND to the
OWNER.

23. ASSIGNMENTS

23.1 Neither the CONTRACTOR nor the OWNER shall sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein, or his obligations thereunder, without written consent of the other party.

24. INDEMNIFICATION

24.1 The CONTRACTOR will indemnify and hold harmless the OWNER and the ENGINEER and their agents and employees from and against all claim, damages, losses and expenses including attorneys' fees arising out of or resulting from the performance of the WORK. provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the CONTRACTOR, and SUBCONTRACTOR, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

24.2 In any and all claims against the OWNER or the ENGINEER, or any of their agents or employees, by any employee of the CONTRACTOR, any SUBCONTRACI'OR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefit payable by or for the CONTRACTOR or any SUBCONTRACTOR under workmen's compensation acts, disability benefit acts or other employee benefits acts.

24.3 The obligation of the CONTRACTOR under this paragraph shall not extend to the liability of the ENGINEER, his agents or employees missing out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, CHANGE ORDERS, designs or SPECIFICATIONS.

25. SEPARATE CONTRACTS

25.1 The OWNER reserves the right to let other contracts in connection with this PROJECT. The CONTRACTOR shall afford other CONTRACTORS reasonable opportunity for the introduction and storage of their materials and the execution of their WORK, and shall properly connect and coordinate his WORK with theirs. If the proper execution or results of any part of the CONTRACTOR'S WORK depends upon the WORK of any other CONTRACTOR, the CONTRACTOR shall inspect and promptly report to the ENGINEER any defects in such WORK that render it unsuitable for such proper execution and results.

25.2 The OWNER may perform additional WORK related to the PROJECT by himself, or he may let other contracts containing provisions similar to these. The CONTRACTOR will afford the other CONTRACTORS who are parties to such Contracts (or the OWNER, if he is performing the additional WORK himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of WORK, and shall properly connect and coordinate his WORK with theirs.

25.3 If the performance of additional WORK by other CONTRACTORS or the OWNER is not noted in the CONTRACT DOCUMENTS prior to the execution of the CONTRACT, written notice thereof shall be given to the CONTRACTOR prior to starting any such additional WORK. If the CONTRACTOR believes that the performance of such additional WORK by the OWNER or others involves him in additional expense or entitles him to an extension of the CONTRACT TIME, he may make a claim therefore as provided in Sections 14 and 15.

26. SUBCONTRACTING

26.1 The CONTRACTOR may utilize the services of specialty SUBCONTRACTORS on those parts of the WORK which, under normal contracting practices, are performed by specialty SUBCONTRACTORS.

26.2 The CONTRACTOR shall not award WORK to SUBCONTRACTOR(s), in excess of fifty (50%) percent of the CONTRACT PRICE, without prior written approval of the OWNER.

26.3 The CONTRACTOR shall be fully responsible to the OWNER for the acts and omissions of his SUBCONTRACTORS, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

26.4 The CONTRACTOR shall cause appropriate provisions to be inserted in all subcontracts relative to the WORK to bind SUBCONTRACTORS to the CONTRACTOR by the terms of the CONTRACT DOCUMENTS insofar as applicable to the WORK or SUBCONTRACTORS and to give the CONTRACTOR the same power as regards terminating any subcontract that the OWNER may exercise over the CONTRACTOR under any provision of the CONTRACT DOCUMENTS.

26.5 Nothing contained in this CONTRACT shall create any contractual relation between any SUBCONTRACTOR and the OWNER.

27. ENGINEER'S AUTHORITY

27.1 The ENGINEER shall act as the OWNER'S representative during the construction period. He shall decide questions which may arise as to quality and acceptability of materials furnished and WORK performed. He shall interpret the intent of the CONTRACT DOCUMENTS in a fair and unbiased manner. The ENGINEER will make visits to the site and determine if the WORK is proceeding in accordance with the CONTRACT DOCUMENTS.

27.2 In the performance of work, the CONTRACTOR shall abide by all orders, instructions and requirements of the ENGINEER and shall perform all work to the satisfaction of the ENGINEER. The CONTRACTOR shall employ no plant equipment, materials, methods or men to which the ENGINEER objects.

27.3 The CONTRACTOR will be held strictly to the intent of the CONTRACT DOCUMENTS in regard to the quality of materials, workmanship and execution of the WORK. Inspections may be made at the factory or fabrication plant of the source of material supply.

27.4 The ENGINEER will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

27.5 The ENGINEER shall promptly make decisions relative to interpretation of the CONTRACT DOCUMENTS.

27.6 Any approval made by the ENGINEER without the OWNER's written authorization shall not further commit OWNER.

28. LAND AND RIGHTS-OF-WAY

28.1 Prior to issuance of NOTICE TO PROCEED, the OWNER shall obtain all land and rights-of-way necessary for carrying out and for the completion of the WORK to be performed pursuant to the CONTRACT DOCUMENTS, unless otherwise mutually agreed.

28.2 The OWNER shall provide to the CONTRACTOR information which delineates and describes the land owned and rights-of-way acquired.

28.3 The CONTRACTOR shall provide at his own expense and without liability to the OWNER any additional land and access thereto that the CONTRACTOR may desire for temporary construction facilities, or for storage of materials.

29. GUARANTY

29.1 The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION. The CONTRACTOR warrants and guarantees for a period of one (1) year from the date of SUBSTANTIAL COMPLETION of the system that the completed

system is free from all defects due to faulty materials or workmanship and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. The OWNER will give notice of observed defects with reasonable promptness. In the event that the CONTRACTOR should fail to make such repairs, adjustments, or other WORK that may be made necessary by such defects, the OWNER may do so and charge the CONTRACTOR the cost thereby incurred. The Performance Bond shall remain in full force and effect through the guarantee period.

30. TAXES

30.1 The CONTRACTOR will pay all sales, consumer, use and other similar taxes required by the law of the place where the WORK is performed.

31. SCALES

31.1 Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the CONTRACTOR, or be certified permanently installed commercial scales.

Scales shall be accurate within one-half percent of the correct weight throughout the range of use. The CONTRACTOR shall have the scales checked under the observation of the inspector before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed one-tenth of 1 percent of the nominal rated capacity of the scale, but not less than 1 pound (454 grams). The use of spring balances will not be permitted.

Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the inspector can safely and conveniently view them.

Scale installations shall have available ten standard 50-pound (2.3 kilogram) weights for testing the weighing equipment or suitable weights and devices for other approved equipment.

Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.

Scales “overweighing" (indicating more than correct weight) will not be permitted to operate, and all materials received subsequent to the last previous correct weighing-accuracy test will be reduced by the percentage of error in excess of one-half of 1 percent.

In the event inspection reveals the scales have been “underweighing” (indicating less than correct weight), they shall be adjusted, and no additional payment to the CONTRACTOR will be allowed for materials previously weighed and recorded.

All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; fur furnishing check weights and scale house; and for all other

items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.

32. PROPOSAL, REQUIREMENTS AND CONDITIONS

32.1. Contents of Proposal Forms: Proposal forms for BIDDERS use are included in the CONTRACT DOCUMENTS.

The PLANS, SPECIFICATIONS, and other documents designated in the proposal form shall be considered a part of the proposal whether attached or not.

32.2 Issuance of Proposal Forms: The OWNER reserves the right to refuse to issue a proposal form to a prospective BIDDER should such BIDDER be in default for any of the following reasons:

A. Failure to comply with any prequalification regulations of the OWNER, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.

B. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force (with the OWNER) at the time the OWNER issues the proposal to a prospective BIDDER.

C. CONTRACTOR default under previous contracts with the OWNER.

D. Unsatisfactory work on previous contracts with the OWNER.

32.3 Interpretation of Estimated Proposal Quantities: An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the award of the contract. The OWNER does not expressly or by implication agree that the actual quantities involved will correspond exactly therewith; nor shall the BIDDER plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the CONTRACTOR will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as hereinafter provided in General Conditions Section 13. titled CHANGES IN THE WORK without in any way invalidating the unit bid prices.

32.4 Examination of Plans, Specifications, and Site: The BIDDER is expected to carefully examine the site of the proposed work, the proposal, PLANS, SPECIFICATIONS, and CONTRACT FORMS. He shall satisfy himself as to the character, quality, and quantities of work to be performed, materials to be furnished, and as to the requirements of the proposed contract. The submission of a proposal shall be prima facie evidence that the BIDDER has made such examination and is satisfied as to the conditions to be encountered in performing

the work and as to the requirements of the proposed CONTRACT, PLANS and SPECIFICATIONS.

Boring logs and other records of subsurface investigations and tests are available for inspection of BIDDERS. It is understood and agreed that such subsurface information whether included in the PLANS, SPECIFICATIONS, or otherwise made available to the BIDDER, was obtained and is intended for the OWNER's design and estimating purposes only. Such information has been made available for the convenience of all BIDDERS. It is further understood and agreed that each BIDDER is solely responsible for all assumptions, deductions, or conclusions which he may make or obtain from his examination of the boring logs and other records of subsurface investigations and tests that are furnished by the OWNER.

32.5 Preparation of Proposal: The BIDDER shall submit his proposal on the forms furnished in the CONTRACT DOCUMENTS. All blank spaces in the proposal forms must be correctly filled in where indicated for each and every item for which a quantity is given. The BIDDER shall state the price (written in ink or typed) both in words and numerals for which he proposes to do each pay item furnished in the proposal. In case of conflict between words and numerals, the words, unless obviously incorrect, shall govern.

The BIDDER shall sign his proposal correctly and in ink. If the proposal is made by an individual, his name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the State under the laws of which the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer.

Anyone signing a proposal as an agent shall file evidence of his authority to do so and that the signature is binding upon the firm or corporation.

32.6 Irregular Proposals: Proposals shall be considered irregular for the following reasons:

A. If the proposal is on a form other than that furnished by the OWNER, or if the OWNER's form is altered, or if any part of the proposal form is detached.

B. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind which make the proposal incomplete, indefinite, or otherwise ambiguous.

C. If the proposal does not contain a unit price for each pay item or alternate item listed in the proposal, except in the case of authorized alternate pay items, for which the BIDDER is not required to furnish a unit price.

D. If the proposal contains unit prices that are obviously unbalanced.

E. If the proposal is not accompanied by the proposal guaranty specified by the OWNER.

For this contract, proposals shall be considered irregular for any of the reasons stated and, in addition, if the proposal is "non-responsive" with respect to the requirements.

The OWNER reserves the right to reject any irregular proposal and the right to waive technicalities if such waiver is in the best interest of the OWNER and conforms to local laws and ordinances pertaining to the letting of construction contracts,

32.7 Proposal Guaranty: Each separate proposal shall be accompanied by a certified check, or other specified acceptable collateral, in the amount specified in the proposal form. Such check, or collateral, shall be made payable to the OWNER.

32.8 Delivery of Proposal: Each proposal submitted shall be placed in a sealed envelope plainly marked with the project number, location of airport, and name and business address of the BIDDER on the outside, lower right-hand corner. When sent by mail, preferably registered, the sealed proposal, marked and indicated above, should be enclosed in an additional envelope. No proposal will be considered unless received at the place specified in the advertisement before the time specified for opening all bids. Proposals received after the bid opening time shall be returned to the BIDDER unopened.

32.9 Withdrawal or Revision of Proposal: A BIDDER may withdraw or revise (by withdrawal of one proposal and submission of another) a proposal provided that the BIDDER'S request for withdrawal is received by the OWNER in writing or by telegram before the time specified for opening bids. Revised proposals must be received at the place specified in the advertisement before the time specified for opening all bids.

32.10 Public Opening of Proposals: Proposals shall be opened and read publicly at the time and place specified in the advertisement. BIDDERS, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the BIDDER unopened.

32.11 Disqualification of BIDDERS: A BIDDER shall be considered disqualified for any of the following reasons:

A. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

B. Evidence of collusion among BIDDERS. BIDDERS participating in such collusion shall be disqualified as BIDDERS for any future work of the OWNER until any such participating BIDDER has been reinstated by the OWNER as a qualified BIDDER.

C. If the BIDDER is considered to be in "default" for any reason specified in subsection 32.2 titled ISSUANCE OF PROPOSAL FORMS.

33 AWARD AND EXECUTION OF CONTRACT

33.1 Consideration of Proposals: After the proposals are publicly opened and read, they will be compared on the basis of the summation of the products obtained by multiplying the estimated quantities shown in the proposal by the unit bid prices. If a BIDDER'S proposal contains a discrepancy between total price written in words and total price written in numbers, the total price written in words shall govern. Unit bid prices will be back calculated based on the total price written in words divided by the quantity.

Until the award of a contract is made, the OWNER reserves the right to reject a BIDDER'S proposal for any of the following reasons:

A. If the proposal is irregular as specified in subsection 32.6 titled IRREGULAR PROPOSALS.

B. If the BIDDER is disqualified for any of the reasons specified in subsection 32.ll titled DISQUALIFICATION OF BIDDERS.

In addition, until the award of a contract is made, the OWNER reserves the right to reject any or all proposals; waive technicalities, if such waiver is in the best interest of the OWNER and is in conformance with applicable State and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work otherwise. All such actions shall promote the OWNER's best interests.

33.2 Award of Contract: The award of a contract, if it is to be awarded, shall be made within 30 calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

Award of the contract shall be made by the OWNER to the lowest, qualified BIDDER whose proposal conforms to the cited requirements of the OWNER. The OWNER reserves the right to accept either the base bid or alternate of any properly submitted bid proposal.

For AIP contracts, unless otherwise specified in this subsection, no award shall be made until the FAA has concurred in the sponsor's recommendation to make such award and has approved the sponsor's proposed contract to the extent that such concurrence and approval are required by Part 152 and/or Part l56 of the Federal Aviation Regulations.

33.3 Cancellation of Award: The OWNER reserves the right to cancel the award without liability to the BIDDER, except return of proposal guaranty, at any time before a contract has been fully executed by all parties and is approved by the OWNER in accordance with subsection 33.7 titled APPROVAL OF CONTRACT.

33.4 Return of Proposal Guaranty: Bid guaranties of the unsuccessful

BIDDERS will be returned within twelve (12) days after bid award. The Bid Guarantee of the successful BIDDER will be returned following acceptance of the contract.

33.5 Requirements of Contract Bonds: At the time of the execution of the contract, the successful BIDDER shall furnish the OWNER a surety bond or bonds which have been fully executed by the BIDDER and his surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the CONTRACTOR'S performance of the work. The surety and the form of the bond or bonds shall be acceptable to the OWNER. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.

33.6 Execution of Contract: The successful BIDDER shall sign (execute) the necessary agreements for entering into the contract and return such signed contract to the OWNER along with certificate of insurance specified in subsection 21.2 and the fully executed surety bond or bonds specified in subsection 33.5 titled REQUIREMENTS OF CONTRACT BONDS, within 4 calendar days from the date in the notice of award. If the contract is mailed, special handling is recommended.

33.7 Approval of Contract: Upon receipt of the contract and contract bond or bonds that have been executed by the successful BIDDER, the OWNER shall complete the execution of the contract in accordance with local laws or ordinances, and return the fully executed contract to the CONTRACTOR.

The OWNER is not bound until the contract is signed by the BIDDER and subsequently signed by an authorized representative of the OWNER. The representative of the OWNER will not sign the contract until the bidder has performed all prerequisites to the execution of the contract including bonding, insurance, licenses and permits.

33.8 Failure to Execute Contract: Failure of the successful bidder to execute the contract and furnish an acceptable surety bond or bonds within the 4 calendar day period specified in subsection 33.5 titled REQUIREMENTS OF CONTRACT BONDS shall be just cause for cancellation of the award and forfeiture of the proposal guaranty, not as a penalty, but as liquidation of damages to the OWNER.

34. LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

34.1 Sanitary, Health, and Safety Provisions: The CONTRACTOR shall provide and maintain in a neat, sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements of the State and local Board of Health, or of other bodies or tribunals having jurisdiction.

Attention is directed to Federal, State, and local laws, rules and regulations concerning construction safety and health standards. The CONTRACTOR shall not require any worker to work in surroundings or under conditions which are unsanitary, hazardous, or dangerous to his health or safety.

34.1 Public Convenience and Safety: The CONTRACTOR shall control his operations and those of his SUBCONTRACTORS and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The CONTRACTOR shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to his own operations and those of his SUBCONTRACTORS and all suppliers in accordance with the requirements of the section titled OPERATIONAL SAFETY ON AIRPORTS DURING CONSTRUCTION and shall limit such operations for the convenience and safety of the traveling public.

34.3 Barricades, Warning Signs, and Hazard Markings: The CONTRACTOR shall furnish, erect, and maintain all barricades, warning signs, and markings for hazards necessary to project the public and the work. When used during periods of darkness, such barricades, warning signs and hazard markings shall be suitably illuminated.
For vehicular and pedestrian traffic, the CONTRACTOR shall furnish, erect, and maintain barricades, warning signs, lights and other traffic control devices in reasonable conformity with the Manual of Uniform Traffic Control Devices for Streets and Highways (published by the United States Government Printing Office).

The CONTRACTOR shall furnish, erect, and maintain markings and associated lighting of open trenches, excavations, temporary stock piles, and his parked construction equipment that may be hazardous to the operation of emergency fire-rescue or maintenance vehicles on the airport.

The CONTRACTOR shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing work which requires such erection and shall maintain the barricades, warning signs, and marking fur hazards until their dismantling is directed by the ENGINEER..

Open-flame type lights shall not be permitted within the air operations areas of the airport.

34.4 Use of Explosives: When the use of explosives is necessary for the prosecution of the work, the CONTRACTOR shall exercise the utmost care not to endanger life or property, including new work. The CONTRACTOR shall be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the ENGINEER and, in general, not closer than 1,000 feet from the work or from any building, road, or other place of human occupancy.

The CONTRACTOR shall notify each property OWNER and public utility company having structures or facilities in proximity to the site of the work of his intention to use explosives.

34.5 No Waiver of Legal Rights: Upon completion of the work, the OWNER will expeditiously make final inspection and notify the CONTRACTOR of final acceptance. Such final acceptance, however, shall not preclude or stop the OWNER from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the OWNER be precluded or stopped from recovering from the CONTRACTOR or his surety, or both, such overpayment as may be sustained, or by failure on the part of the CONTRACTOR to fulfill his obligations under the contract. A waiver on the part of the OWNER of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The CONTRACTOR, without prejudice to the terms of the Contract, shall be liable to the OWNER for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the OWNER'S rights under any warranty or guaranty.

34.6 Environmental Protection: The CONTRACTOR shall comply with all Federal, State, and local laws and regulations controlling pollution of the environment. He shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumen, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

34.7 Archaeological and Historical Findings: Unless otherwise specified in this subsection, the CONTRACTOR is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.
Should the CONTRACTOR encounter, during his operations, any building, part of a building, structure, or object which is incongruous with its surroundings, he shall immediately cease operations in that location and notify the ENGINEER. The ENGINEER will immediately investigate the CONTRACTOR'S finding and will direct the CONTRACTOR to either resume his operations or to suspend operations as directed.

Should the ENGINEER order suspension of the CONTRACTOR’s operations in order to protect an archaeological or historical finding, or other CONTRAC'TOR to perform extra work, such shall be covered by an appropriate contract modification change order or supplemental agreement) as provided in General Conditions Section 13. titled CHANGES IN THE WORK. If appropriate, the contract modification shall include an extension of contract time.

34.8 CONTRACTORS Insurance: The CONTRACTOR shall agree to carry all insurance which may be required by Federal and State laws, and local ordinances, regulations, and codes.

Concurrently with the execution of the contract, the CONTRACTOR shall furnish

the OWNER the following:

A. Public Liability and Property Damage Insurance: A certificate of insurance that the CONTRACTOR shall maintain during the life of the contract such public liability and property damage insurance, both general and automobile liability, as shall protect him and nay SUBCONTRACTOR performing work under the contract from all claims for bodily injury, including accidental death, as well as for property damage arising from operations under the contract, whether such operation be by himself or by a SUBCONTRACTOR or by anyone directly or indirectly employed by either of them. The CONTRACTOR shall obtain a certificate of insurance with the executed contract specifying all insurance coverage required by contract. The CONTRACTOR may use the form at the back or a certificate provided by his insurance company. Insurance limits requirements are stipulated on pages GC-11 and GC-12. The certificate of insurance is considered part of and required with the executed contract. The notice to proceed will not be issued until the certificate of insurance is delivered to the OWNER. This certificate shall be issued by an insurance company authorized by the Insurance Department of Arizona to transact business in the State of Arizona.

B. Workmen's and Occupational Disease Compensation: A letter of certification, from the Industrial Commission of Arizona, that the CONTRACTOR is insured by the State Compensation Fund or is an authorized self-insurer or a certificate of in surance issued by an insurance company authorized by the Insurance Department of Arizona to write workmen's compensation and occupational disease insurance in the State of Arizona.

C. Builder's Risk/Course of Construction Insurance: When the project includes construction of a new or modification of an existing building, the CONTRACTOR shall obtain fire and extended coverage plus vandalism and malicious mischief for the full amount of the contract in addition to coverage (a) and (b), with the contracting agency named as an additional insured.

D. The OWNER shall be named as additional insured on any or all liability policies required by the Contract.

SECTION C:
TECHNICAL SPECIFICATIONS

Section 152. — CONSTRUCTION SURVEY AND STAKING

Description

152.01 This work consists of performing surveying, staking, calculating, and recording data for the control of work. See FAR Clause 52.236-17 Layout of Work.

Construction Requirements

152.02 Qualifications. Provide technically qualified survey crews experienced in highway construction survey and staking. Provide personnel capable of performing in a timely and accurate manner.

152.03 Submittals. Submit the following at the preconstruction conference:

Include the following when Automated Machine Guidance **(**AMG) methods are used:

(a) Technology statement. A written statement that includes:

(1) The manufacturer, model, and software version of the AMG equipment; and

(2) Certification that the final 3D data is compatible with the AMG equipment.

(b) Personnel qualifications.

(1) The name, authority, relevant experience, and qualifications of the person with overall responsibility for the AMG system.

(2) The names, authority, and relevant experience of personnel directly responsible for operating the AMG equipment.

(c) Contractor quality control plan. Comply with Section 153 and describe procedures for checking, mechanical calibration, and maintenance of both survey and construction equipment. Include the frequency and types of checks performed.

Include a price breakdown by individual tasks when construction survey and staking is paid by the lump sum for use in making progress payments and price adjustments.

152.04 General. Conform to the following:

(a) Personnel. Provide a crew supervisor on the project whenever surveying and staking is in progress.

(b) Equipment. Furnish survey instruments and supporting equipment capable of achieving the specified tolerances.

Construction equipment controlled with a Global Positioning System (GPS) and Robotic Total Station (RTS) machine guidance system may be used in the construction of subgrade, subbase, and base aggregate courses, or other construction operations when approved.

(c) Material. Furnish acceptable tools and supplies of the type and quality suitable for highway survey work. Furnish stakes and hubs of sufficient length to provide a solid set in the ground with sufficient surface area above ground for necessary legible and durable markings.

Include staking activities in the construction schedule required under Section 155. Include the dates and sequence of each staking activity.

The Government will set horizontal control points, vertical control points, and will provide data for use in establishing control for completion of each element of the work.

Data relating to horizontal and vertical alignment, theoretical slope stake catch points, and other design data will be furnished. Reformatting and additional calculations may be required for the convenient use of the Government-furnished data. Provide immediate notification of apparent errors in the initial staking or in the Government-furnished data.

Record survey and measurement field data in an approved format. Submit as-staked data and corrections made to the Government-furnished survey data. Submit survey and measurement data at least weekly. Field data and supporting documentation become the property of the Government upon completion of the work.

Discuss and coordinate the following with the CO before surveying or staking:

(1) Surveying and staking methods;

(2) Stake marking;

(3) Grade control for courses of material;

(4) Referencing;

(5) Structure control;

(6) Field staking data;

(7) Localization of the GPS systems to the Government-established control points; and

(8) Other procedures and controls necessary for the work.

Do not start work until staking or three-dimensional (3D) verification data for the affected work has been approved.

Preserve initial reference and control points. Notify the CO of missing control points or stakes at least 10 days before beginning construction. The Government will reestablish control points missing before the beginning of construction.

Acceptance of the construction staking does not relieve the Contractor of responsibility for correcting errors discovered during the work and for bearing additional costs associated with the error.

Maintain legibility of stake markings for the duration of the project or until notified in writing the stakes are no longer needed. Replace stakes if necessary to ensure markings are maintained.

Remove and dispose of flagging, paint, lath, stakes, and other staking material after the project is complete.

152.05 Survey and Staking Requirements. Perform survey, staking, recording of data, and calculations as necessary to construct the project from the initial layout to final completion. Survey and set stakes to the tolerances in Table 152-1. Reset stakes, refine 3D data, or both as many times as necessary to construct the work.

(a) Control points. Relocate initial horizontal and vertical control points in conflict with construction to areas that will not be disturbed by construction operations. Furnish the coordinates, elevations, and supporting documentation for the relocated points before the initial points are disturbed. Set durable monuments for survey control that uniquely identify the points.

Furnish the GPS localization results at least 7 days before beginning construction layout survey work. The CO may order the GPS localization calibration and associated 3D model to be broken into two or more zones to maintain the localized relationship between control points and original ground.

(b) Centerline establishment. Establish or reestablish centerline at roadway design cross-section locations and as necessary to construct the work. Reestablish the centerline when construction survey and staking work does not meet the tolerances.

(c) Original ground topographic verification. Use an approved method to regenerate cross-section data in areas where theoretical and actual ground elevations do not meet a tolerance of plus or minus 0.5 feet (150 millimeters). Retake cross-section to verify existing ground topography to mapping. Submit cross-section or 3D data in electronic and printed format for approval. Reduce cross-sections to horizontal and vertical distances from centerline.

Retake cross-section 10 feet (3 meters) beyond catch points to verify existing ground topography.

(d) Slope and references stakes. Perform the following:

(1) AMG method. After clearing operations are completed, set centerline reference stakes and hubs on both sides of centerline at 100-foot (30-meter) intervals at the clearing limit locations. Where clearing limits are greater than 10 feet (3 meters) vertically, 25 feet (8 meters) horizontally, or both from subgrade hinge point; provide an additional reference stake and hub as approved by the CO. Label each centerline reference stake with station, hub elevation, and offset from centerline.

Construct a 1000-foot (300-meter) long test section using AMG on the project at an approved location before beginning grading operations. Select a test location with superelevation and curve widening transitions if applicable. Notify the CO 10 days before beginning the test section. Demonstrate capability, knowledge, equipment, and experience to achieve work within tolerances. Allow 14 days to evaluate the test section. Do not start full grading operations until the test section is approved.

Provide as-built cross-sections at random locations specified by the CO not to exceed 500-foot (150-meter) intervals. If as-built cross-sections do not meet the tolerances in Subsection 204.13(d); rework the section until the specified tolerances are achieved and provide additional cross-sections as directed by the CO at no cost to the Government.

(2) Conventional survey methods. Verify and set slope stakes on both sides of centerline at the theoretical catch point. If the theoretical catch point is not within a tolerance of 0.5 feet (150 millimeters), perform original ground topographic verification according to Subsection 152.05(c). Set the slope stake at the actual intersection of the design roadway slope with the natural ground-line. Set reference stakes outside the clearing limits. Include reference points and slope-stake information on the reference stakes.

Establish slope stakes in the field as the actual point of intersection of the design roadway slope with the natural ground-line when theoretical catch point information is not available.

(e) Clearing and grubbing limits. Set clearing and grubbing limits on both sides of centerline based on the actual slope-stake locations.

(f) Grade-finishing stakes.

(1) AMG method. Construct a 1000-foot (300-meter) long test section using AMG on the project at an approved location before beginning grading operations. Select a test location with superelevation and curve widening transitions if applicable. Notify the CO 10 days before beginning the test section. Demonstrate the capability, knowledge, equipment, and experience to achieve work within tolerances. Allow 14 days to evaluate the test section. Do not start full grading operations until the test section is approved.

Verify the grade elevation and horizontal alignment of roadway grade-finishing operations. Use conventional survey methods at random locations specified by the CO, not to exceed 500-foot (150-meter) intervals. Submit 3D coordinates of grade-finishing quality control checks.

(2) Conventional survey methods. Set grade-finishing stakes for grade elevations and horizontal alignment, on centerline and on each shoulder at design roadway cross-section locations. Set stakes at the top of subgrade and the top of each aggregate course. Reset grade finishing stakes as many times as necessary to construct the subgrade and each aggregate course.

During turnout or pullout construction, set stakes on the centerline, on each normal shoulder, and on the shoulder of the turnout. In parking areas, set stakes at the center and along the edges of the parking area. Set stakes in ditches to be paved.

When the centerline curve radius is less than or equal to 250 feet (75 meters), use a maximum longitudinal spacing between stakes of 25 feet (8 meters). When the centerline curve radius is greater than 250 feet (75 meters), use a maximum longitudinal spacing between stakes of 50 feet (15 meters). Use a maximum transverse spacing between stakes of 20 feet (6 meters). Use brushes or guard stakes at each stake.

(g) Culverts. Verify and set culvert locations at the inlet, outlet, and inlet basin points according to the plans. Perform the following if culvert design does not fit field conditions:

(1) Survey and record the ground profile along the culvert centerline;

(2) Determine the slope catch points at the inlet and outlet;

(3) Set reference points and record information necessary to determine culvert length and end treatments;

(4) Plot to scale the profile along the culvert centerline. Show the natural ground, the flow line, the roadway section, and the culvert including end treatments and other appurtenances. Show elevations, grade, culvert length, and degree of elbow.

(a) For single skewed culverts, submit a plotted field-design cross-section normal to roadway centerline and at each end section. Plot the offset and elevation of natural ground at the end section and at proposed template break points between centerline and the end section. Ensure the template design embankment slope is not exceeded;

(b) For multiple skewed culverts, submit a plotted field design cross-section normal to roadway centerline and at the end sections (left and right) nearest to the shoulder. Plot the offset and elevation of natural ground at the end section and at proposed template break points between centerline and the end section. Ensure the template design embankment slope is not exceeded;

(c) Submit the plotted field-design cross-section for approval of final culvert length and alignment. Plot at a clear and readable scale;

(d) Set inlet, outlet, and reference stakes when the field design has been approved. Stake inlet and outlet ditches to make sure the culvert and end treatments (such as drop inlets) are functional; and

(e) Adjust slope, reference, and clearing stakes as necessary to provide for culvert inlet treatments in cut slopes. Readjust slope, reference, and clearing stakes as necessary when culvert inlets are moved from their plan locations. Review slope adjustments with the CO and obtain approval.

(h) Bridges. Set adequate horizontal and vertical control and reference points for bridge substructure and superstructure components. Establish and reference the bridge chord, bridge tangent, or control lines as specified on the bridge plans. Also establish and reference the centerline of each pier, bent, and abutment.

(i) Retaining walls and reinforced soil slopes. Survey and record profile measurements along the face of the proposed wall or reinforced soil slope at 5 feet (1.5 meters) and 10 feet (3 meters) in front of the wall or slope face. Take cross-sections every 25 feet (8 meters) along the length of the wall or reinforced soil slope and at major breaks in terrain within the limits designated by the CO. Measure and record points every 25 feet (8 meters) and at major breaks in terrain for each cross-section. Set additional references and control points to perform the work.

(j) Borrow and waste sites. Perform field work necessary for initial layout and measurement of the borrow or waste site. Establish site limits and clearing limits. Measure both original and final ground conditions and submit cross-sections as directed by the CO.

(k) Permanent monuments and markers. Perform survey and staking work necessary to establish permanent monuments and markers as described in Section 621 or reestablish monuments as described in Subsection 107.02.

(l) Miscellaneous survey and staking. Survey and stake other work (such as guardrail, curb and gutter, turf establishment, utilities, and excavation limits for structures) to the proper location and required tolerances. Propose staking increments for approval by the CO when not specified.

Table 152-1
Construction Survey and Staking Tolerances [1]

Staking Phase	Horizontal	Vertical
Control points set from existing Government control points	±0.03 feet (±10 millimeters)	±0.01 feet × $\sqrt{N}$ (±3 millimeters × $\sqrt{N}$)[2]
Mapping, topography, and cross-section points	±0.16 feet (±50 millimeters)	±0.16 feet (±50 millimeters)
Centerline points [3] including (PC), (PT), (POT),(POC), and references	±0.06 feet (±20 millimeters)	±0.06 feet (±20 millimeters)
Slope-stake and slope-stake references [4]	±0.16 feet (±50 millimeters)	±0.16 feet ±50 millimeters)
Culverts, ditches, and minor drainage structures stakes	±0.16 feet (±50 millimeters)	±0.06 feet (±20 millimeters)
Retaining walls stakes	±0.06 feet (±20 millimeters)	±0.03 feet (±10 millimeters)
Curb and gutter stakes	±0.06 feet (±20 millimeters)	±0.03 feet (±10 millimeters)
Bridge substructures stakes	±0.03 feet (±10 millimeters)[5]	±0.03 feet (±10 millimeters)
Bridge superstructures stakes	±0.03 feet (±10 millimeters)[5]	±0.03 feet (±10 millimeters)
Clearing and grubbing limit stakes	±1.00 feet (±300 millimeters)	–
Roadway subgrade finish stakes [6]	±0.16 feet (±50 millimeters)	±0.03 feet (±10 millimeters)
Roadway finish grade stakes [6]	±0.16 feet (±50 millimeters)	±0.03 feet (±10 millimeters)

(1) At statistical 95 percent confidence level. Tolerances are relative to existing Government control points.
(2) N is the number of instrument setups.
(3) Centerline points: PC - point of curve, PT - point of tangent, POT - point on tangent, POC - point on curve.
(4) Take the cross-sections normal to the centerline ±1 degree.
(5) Bridge control is established as a local network and the tolerances are relative to that network.
(6) Includes paved ditches.

152.06 Acceptance. Construction survey and staking will be evaluated under Subsections 106.02 and 106.04.

Survey notes will be evaluated under Subsection 106.02.

Measurement

152.07 Measure the Section 152 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When measuring grade finishing, measure one time for the subgrade and one time for each aggregate course.

When measuring miscellaneous survey and staking paid by the hour; do not measure time spent in making preparations, traveling to and from the project site, performing calculations, plotting cross-sections and other data, processing computer data, and other efforts necessary to successfully accomplish construction survey and staking.

Do not measure re-establishing missing control points or stakes after construction operations have begun.

Payment

152.08 The accepted quantities will be paid at the contract price per unit of measurement for the Section 152 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Payment for lump sum pay items will be prorated based on the progress of the work under this Section.

Section 153. — CONTRACTOR QUALITY CONTROL

Description

153.01 This work consists of planning and implementing a construction quality process to ensure work conforms to the contract. This work also includes quality control inspection and documentation, and process control sampling and testing. See FAR Clause 52.246-12 Inspection of Construction.

Construction Requirements

153.02 Qualifications. Submit the following for approval with the Quality Control Plan:

(a) Quality control manager (QCM). Provide a QCM according to (1) or (2) below. If neither is specified, conform to (1).

(1) Full-time, on-site QCM. Provide a QCM with no responsibilities for performing testing and inspection, managing the project, or performing operations other than managing quality control and the following:

(a) One year experience managing quality control on construction projects of similar type and scope, and

(b) One of the following:

(1) Two years' experience as a construction project manager or superintendent on construction projects of similar type and scope;

(2) Three years' experience as a project engineer, resident engineer, foreman, construction inspector, or equivalent on construction projects of similar type and scope; or

(3) National Institute for Certification in Engineering Technologies (NICET) Level III certification or equivalent in highway construction or highway material.

(2) Part-time, on-site QCM. Furnish a QCM who has at least 2 years' experience in highway construction, inspection, quality control, and material testing.

(b) Inspectors. Provide inspectors with at least 2 years' experience inspecting projects of similar complexity and with training related to the work to be inspected.

(c) Testers. Provide testers with at least one year experience in the type of sampling and testing required, and with one of the following for the type of sampling and testing performed:

(1) NICET Level II certification in highway material or equivalent state or industry certification;

(2) Certification by a regional certification program (such as Western Alliance for Quality Transportation Construction (WAQTC), Northeast Transportation Technician Certification Program (NETTCP), Southeast Task Force for Technician Training and Qualification (STFTTQ), or Multi Regional Training and Certification (M-TRAC)); or

(3) At least one year employment by an AASHTO accredited laboratory performing equivalent sampling and testing.

153.03 Quality Control Plan (QCP). Develop a QCP addressing all contract work categories. A category consists of related work items performed in one operation(such as excavation, drainage, and paving). Include the work of subcontractors, major material suppliers, and structural and geotechnical services suppliers.

For each category, include the following:

(a) Quality control personnel. Furnish the name, authority, responsibilities, and qualifications of the quality control manager and other personnel directly involved in inspection and testing. Conform to Subsection 153.02.

(b) Quality control procedures. Describe the inspection, testing, and other activities to be performed for each phase of work in Subsection 153.04. Include methods, schedules, equipment, and laboratory facilities. Conform to Subsections 153.04 and 153.05.

List the material to be tested by:

(1) Pay item;

(2) Applicable requirements of the Sampling, Testing, and Acceptance Requirements tables;

(3) Persons responsible for performing the sampling and testing;

(4) Laboratory testing facilities to be used for process control and project testing; and

(5) Proposed reporting formats.

As a minimum perform process control testing according to the Sampling, Testing, and Acceptance Requirements tables included at the end of each Section where applicable.

(c) Records. Describe the reporting format for inspection, testing, certification, and daily reports. Conform to Subsections 153.06 and 153.07.

At least 14 days before the start of work, submit the QCP for approval. Do not perform work on a work category unless the quality control for that category is accepted. Approval does not imply that the QCP will result in contract compliance.

Revise the QCP when contract quality requirements are not achieved and when changes occur in the contract, work progress, or personnel.

153.04 Prosecution of Work. Complete the following:

(a) Preparatory phase.

(1) Before starting each work category, hold a preparatory phase meeting. Include the project superintendent, work foreman, CO, QCM, and appropriate subcontractors. Be prepared to discuss the following:

(a) Contract requirements for the work, including acceptance procedures, schedule, and control strip;

(b) Process and equipment for constructing the work; and

(c) Plan for inspection, process control, testing, measuring, and reporting the work.

(2) Review and coordinate certifications, submittals, plans, drawings, and permits.

(3) Verify the capabilities of equipment, material, and personnel. Provide training as necessary.

(4) Establish a detailed testing schedule based on the production schedule.

(5) Ensure preparatory testing and inspection is accomplished.

(6) Review accuracy of the surveying and staking.

(b) Start-up phase.

(1) Hold a start-up meeting to review the contract, the construction processes, and the inspection, testing, and reporting requirements with the personnel performing the work. Include the project superintendent, inspectors, testers, CO, and QCM. Explain procedures that will be followed if defective work is identified.

(2) Inspect, test, and report start-up work according to the QCP and ensure the work conforms to the contract.

(c) Production phase.

(1) Inspect, test, and report according to the QCP and evaluate the acceptability of the work produced.

(2) Identify and correct deficiencies.

(3) Request Government inspection and acceptance.

153.05 Sampling and Testing. Inspect commercial laboratory equipment within 45 days of project use.

Have mobile laboratory equipment inspected and calibrated after the laboratory is moved to the project and every time it is moved thereafter. Keep laboratory facilities clean and maintain equipment in proper working condition. Certify that equipment conforms to testing requirements and submit evidence of current calibrations.

Allow the CO unrestricted access to the laboratory for inspection and review. When requested by the CO, provide additional inspections and tests to demonstrate sampling and testing proficiency. Submit proficiency sample test results within 48 hours of sample receipt.

Perform quality control sampling and testing according to the QCP and the sampling, testing, and acceptance requirements table in applicable sections.

When no sampling frequencies are specified, submit the proposed sampling and testing frequencies.

153.06 Certifications. Obtain, review, and verify certifications for work. Submit certifications when required.

153.07 Records and Control Charts. Maintain records and control charts by pay item.

(a) Quality control and construction operations reports. Submit written quality control and construction operations reports daily according to the QCP. Document meetings, work locations, labor and equipment used including actual hours worked, testing and measurement activities, inspection results, deficiencies observed, corrective actions taken, and process changes. Use FHWA Form 1413, *Inspector's Daily Record of Construction Operations* or approved alternate forms. Include the following certification signed by the QCM on all reports:

> "*I certify that the information contained in this record is accurate and that work documented herein complies with the contract. Exceptions to this certification are documented as a part of this record.*"

(b) Control charts. Maintain linear control charts that identify the test number, test parameter, upper and lower specification limit applicable to each test parameter, and test results for applicable material. Use the control charts to document variability of the process, to identify production and equipment problems, and to identify actions to improve processes or quality.

Update and post control charts daily in a location accessible to the CO. Cease production and correct the process when problems are evident.

153.08 Acceptance. The Contractor's quality control system will be evaluated under Subsection 106.02 based on its demonstrated effectiveness to ensure work conforms to the contract.

Measurement and Payment

153.09 Do not measure Contractor quality control for payment. See Subsection 109.05.

Section 156. — PUBLIC TRAFFIC

Description

156.01 This work consists of controlling and protecting public traffic adjacent to and within the project. See FAR Clause 52.236-13 Accident Prevention.

Material

156.02 Conform to the following Section:

Temporary traffic control	635

Construction Requirements

156.03 Qualifications. Provide a traffic control supervisor certified by a state department of transportation, ATSSA, or other acceptable certification programs.

156.04 Accommodating Traffic During Work. Accommodate traffic according to the MUTCD, contract traffic control plan, Section 635, and this Section. An alternate traffic control plan may be submitted for approval according to Subsection 104.03. Submit alternate traffic control plans at least 30 days before intended use.

Perform work in a manner that ensures the safety and convenience of the public and protects the residents and property adjacent to the project. Accommodate public traffic on roads adjacent to and within the project until the project is accepted according to Subsection 106.07(b).

156.05 Maintaining Roadways During Work. Maintain roadways as follows:

(a) Construct and remove diversion roads and bridges as required by the traffic control plan;

(b) Maintain intersections with trails, roads, streets, businesses, parking lots, residences, garages, farms, and other features;

(c) Snow removal to facilitate the work is the Contractor's responsibility. Snow removal to provide public access is the responsibility of the maintaining agency and will be performed at the maintaining agency's discretion. Allow the maintaining agency access to perform snow removal;

(d) Maintain a dust-free traveled way such that visibility and air quality are not affected and a hazardous condition is not created;

(e) Remove accumulations of soil and other material from traveled way;

(f) Do not allow water to pond on the traveled way; and

(g) Maintain the roadway, detours, and diversions in a safe and acceptable condition.

If corrective action is requested and the corrective action is not taken immediately, the condition may be corrected and the cost of the corrective action deducted from monies due the Contractor.

156.06 Maintaining Roadways During Non-Work Periods. Maintain roadways and traffic control for public traffic during periods when work is not in progress. Snow removal to provide public access is the responsibility of the maintaining agency.

156.07 Limitations on Construction Operations. When the roadway is open to public traffic, restrict operations as follows:

(a) Operate equipment in the direction of traffic, where practical;

(b) For shoulder drop-offs of 3 inches (75 millimeters) or less, provide "*Low Shoulder*" warning signs. For shoulder drop-offs in excess of 3 inches (75 millimeters), provide a 1V:3H fillet with "*Shoulder Drop-Off*" warning signs. Complete the construction of shoulders adjacent to traffic lanes to the same elevation within 14 days;

(c) Provide minimum lane widths of 10 feet (3 meters). Use barricades, drums, or other acceptable devices to delineate traffic lanes through areas where the edge of pavement or intended path has been obliterated by construction operations;

(d) Locate staging areas at least 30 feet (9 meters) from the traveled way or behind acceptable traffic barriers. Obtain approval of the location and access to staging areas. Store unused traffic control devices at staging areas;

(e) Park equipment at least 30 feet (9 meters) from the traveled way or behind acceptable traffic barriers;

(f) Provide parking areas for employee’s personal vehicles in approved areas;

(g) Provide uninterrupted two-way communications between flaggers and also between flaggers and pilot cars unless flaggers are able to see each other and communicate. Use communications devices approved by the CO. Citizen band radios are unacceptable. Make communication devices available to the CO as necessary;

(h) Where switching traffic to a completed lane, provide adequate personnel and equipment to set or relocate traffic control devices;

(i) Limit construction-caused delays to public traffic to a maximum of 30 minutes per passage through the project; and

(j) Maintain existing guardrails, barriers, and bridge railings until removal is necessary for construction. Use a temporary barrier or appropriate channelizing devices while the guardrails and bridge rails are absent. Install permanent barriers, guardrails, and bridge rails as soon as possible to minimize risk to the public.

156.08 Nighttime Operations. Perform construction operations during the hours of daylight (one-half hour after sunrise to one-half hour before sunset).

Where night operations are permitted, submit a night lighting system for approval. Include the light types, locations, and the manner in which the lights will be moved. Submit the proposed system at least 14 days before use. Use an independent source other than vehicle headlights. Do not use incandescent lights. Furnish and install the approved system to illuminate the entire work area. Position the lights so they do not shine directly at motorists traveling from any direction. If the operation is moving, move the lighting with the operation. Provide lighting at each flagger location. Equip vehicles with an exterior flashing yellow dome light.

156.09 Traffic Control Supervisor. Provide a traffic control supervisor according to Subsection 156.03. Do not designate the superintendent as the traffic control supervisor. Furnish the traffic control supervisor's name, address, and 24-hour telephone numbers at the preconstruction conference. During the contract, including periods of suspensions and work stoppages, perform the following:

(a) Implement the traffic control plan.

(b) Coordinate traffic control operations, including those of subcontractors and suppliers.

(c) Ensure the condition, position, and applicability of traffic control devices in use.

(d) Immediately correct traffic control deficiencies.

(e) Coordinate traffic control maintenance operations with the CO.

(f) Coordinate and ensure that traffic control devices are furnished, installed, maintained, removed, stored, replaced, relocated and cleaned according to Subsection 635.04. Ensure unused traffic control devices are properly handled and stored.

(g) Conduct weekly traffic safety meetings for construction workers, and invite the CO to these weekly meetings.

(h) Submit a weekly certification that inspections and reviews were conducted and that the traffic control devices meet contract requirements. Include the number and types of devices in use. Report with the weekly certification, changes or corrective actions taken to ensure the safe passage of public traffic through the project.

(i) Inspect traffic control devices, including those in staging, storage, material sources, and disposal areas, as follows:

(1) Daily during daylight hours when daylight work is being performed;

(2) Daily during hours of darkness when nighttime work is being performed;

(3) Weekly during:

(a) Daylight hours and hours of darkness when work is suspended for periods of more than one week, except when the project has been shut down for the winter; and

(b) Periods of winter suspension, inspect only as requested by the CO.

(4) Additional inspections, day or night, as directed by the CO; and

(5) Submit reports of inspections in an acceptable format within 2 days.

(j) Before winter suspension, conduct an inspection of the project with the CO to ensure proper provisions are made for winter travel during the period of suspension.

(k) Provide temporary flagging assistance.

156.10 Acceptance. Public traffic work will be evaluated under Subsection 106.02.

Traffic control devices and services will be evaluated under Section 635.

Measurement and Payment

156.11 Do not measure controlling and protecting public traffic for payment. See Subsection 109.05.

Measure temporary traffic control under Section 635.

Measure dust abatement under Section 158 or 312.

Section 158. — WATERING FOR DUST CONTROL

Description

158.01 This work consists of furnishing and applying water for the control of dust caused by the work and public travel.

Material

158.02 Conform to the following Subsection:

Water	725.01(c)

Construction Requirements

158.03 General. Provide an adequate water supply and apply water uniformly across the traveled way as necessary to control dust. Uniformly apply water using pressure-type distributors, pipelines equipped with spray systems, or hoses with nozzles.

(a) Project dust control for public benefit. Control dust within the construction limits as necessary including nights, weekends, and periods of non-work when the project is open to public traffic. When the project is not open to public traffic, control dust in areas of the project that have adjacent residences or businesses. Control dust on approved, active detours established for the project. Apply water at the locations, rates, and frequencies as ordered.

(b) Other dust control. Control dust on active haul roads, in pits and staging areas, and on the project during periods not covered in Subsection 158.03(a).

158.04 Acceptance. Water will be evaluated under Subsection 106.02.

Furnishing and applying water will be evaluated under Subsection 106.02.

Measurement

158.05 Measure the Section 158 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When measuring water for dust control by volume or mass; measure in the hauling vehicle, or by metering.

Do not measure water for dust control applied according to Subsection 158.03(b).

Payment

158.06 The accepted quantities will be paid at the contract price per unit of measurement for the Section 158 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

CLEARING AND GRUBBING

201.1 DESCRIPTION:

This work shall consist of removing objectionable material from the right-of-way, easements and such other areas as may be specified in the special provisions. Clearing and grubbing shall be performed in advance of grading operations.

201.2 PRESERVATION OF PROPERTY:

Existing improvements, adjacent property, utilities and other facilities, and trees and plants not to be removed, shall be protected from injury or damage resulting from the Contractor's operations, see Section 107.

201.3 CONSTRUCTION METHODS:

The construction site and areas on each side of the roadway from centerline to the toe of an embankment, the top of a cut slope, the slope rounding limit or to a line 10 feet outside the edge of the surfaced area, whichever is greater, but not beyond the limits of the right-of-way, shall be cleared of all trees, stumps, brush, roots, rubbish, debris and other objectionable matter, except as follows.

All trees and shrubs found suitable for improvement and beautification, which will not interfere with excavation or embankment or cause disintegration of the improvements shall not be disturbed. In any event, the Contractor shall avoid, as far as practicable, injury to shrubbery, vines, plants, grasses and other vegetation growing outside of the clearing limits. The dragging and the piling of materials of various kinds and the performing of other work which may be injurious to vegetation shall, insofar as practicable, be confined to areas which have no vegetation or which will be covered by embankment or disturbed by excavation during grading operations.

For the full width of all water courses within the right-of-way lines, no stump, root or other obstruction shall be left higher than the natural stream bed.

From excavated areas, all stumps, roots and other obstructions 3 inches or over in diameter shall be grubbed to a depth of not less than 18 inches below finish grade.

In embankment areas or other areas to be cleared outside the road prism slope lines, all stumps, roots and other obstructions shall not be left higher than specified in Table 201-1.

TABLE 201-1
EMBANKMENT CLEARING AND GRUBBING

Height of Embankment Over Stump	Height of Clearing and Grubbing
0 Feet to 2 Feet	All stumps or roots 6 inches or over in diameter shall be grubbed to 18 inches below original grade. All others shall be cut flush with the ground.
2 Feet to 3 Feet	All stumps 1 foot and over in diameter shall be grubbed to 18 inches below original grade. All others shall be cut flush with the ground.
Over 3 Feet	No stumps shall be left higher than the stump top diameter, and in no case more than 18 inches.

Cavities left below subgrade elevation by removal of stumps or roots shall be carefully backfilled and compacted.

Tree branches extending over the roadway, which hang within 12 feet of the profile grade or that restrict sight distance shall be cut off close to the trunk or stem of the tree in a neat and workmanlike manner. The Contractor shall remove additional tree branches under the direction of the Engineer, in such a manner that the tree will present a balanced appearance. Scars resulting from the removal of branches shall be treated with a heavy coat of an approved tree sealant.

All tree trunks, stumps, brush, limbs, roots, vegetation and other debris removed in clearing and grubbing shall be removed to locations outside of and out of sight of the right-of-way, or otherwise disposed of so as to leave the construction site and adjacent areas in a neat and finished condition, free from unsightly debris.

201.4 REMOVAL AND DISPOSAL OF SALVAGEABLE ITEMS:

Items and materials of salvage value as determined by the Engineer, unless incorporated in the new work, shall remain the property of the Contracting Agency and shall be storaged in adjacent areas as directed by the Engineer. Such items and materials shall be carefully removed and in such a manner as to permit reuse.

201.5 PAYMENT, CLEARING AND GRUBBING:

Unless otherwise provided in the special provisions or bid proposal, no payment will be made for clearing and grubbing as such; the cost thereof shall be included in the bid price for the construction or installation of the items to which said clearing and grubbing are incidental or appurtenant.

201.6 MEASUREMENT, REMOVAL AND DISPOSAL OF TREES:

If the proposal includes separate estimates of quantities for the removal of trees, the tree will be classified by size as follows:

(A) Trees 12 inches or less in diameter at 1-foot above the original ground surface will be included in the bid price for clearing and grubbing or excavation and no additional compensation will be allowed therefore.

(B) Trees more than 12 inches in diameter at 1-foot above the original ground will be included as separate bid item and payment will be made at the unit bid price quoted in the proposal.

201.7 PAYMENT, REMOVAL AND DISPOSAL OF TREES:

Payment for removal of trees will be on a unit price for each tree measured and removed, in accordance with the above classifications, at the unit price stipulated in the proposal.

- End of Section -

ROADWAY EXCAVATION

205.1 DESCRIPTION:

Roadway excavation shall consist of excavation involved in the grading and construction of roadways, except structure excavation, trench excavation and any other excavation separately designated.

205.2 UNSUITABLE MATERIAL:

Material shall be considered unsuitable for fill, subgrade, shoulders and other uses if it contains organic matter, soft spongy earth, or other matter of such nature that compaction to the specified density is unobtainable.

Material that is unsuitable for the intended use shall be excavated and removed from the site or otherwise disposed of as directed by the Engineer.

The removal and disposal of such unsuitable material will be paid for as roadway excavation.

205.3 OVERSHOOTING:

Material outside the authorized cross-section which may be shattered or loosened because of blasting shall be removed by the Contractor at no additional cost to the Contracting Agency. The Contractor shall discontinue any method of blasting which in the opinion of the Engineer leads to excessive overshooting or is dangerous to the public or destructive to property or to natural features.

205.4 SLIDES AND SLIPOUTS:

Material outside the planned roadway or ditch slopes which in the opinion of the Engineer is unstable and constitutes potential slides, material which has come into the roadway or ditch, and material which has slipped out of new or old embankments shall be excavated to designated lines or slopes either by benching or in such manner as directed by the Engineer. Such material shall be used in the construction of the embankments or disposed of as directed by the Engineer.

The removal and disposal of slide and slipout material as specified above, not resulting from overshooting as specified above, will be paid for at the contract prices for roadway excavation; however, if due to the character of the work, the removal and disposal of such material is not properly compensable at the contract prices for roadway excavation, the work may be paid for as extra work provided the Contractor requests in writing such payment prior to performing any such work.

Only those quantities of slide or slipout material which are actually removed as ordered by the Engineer will be paid for.

205.5 SLOPES:

Excavation slopes shall be finished in conformance with the lines and grades shown on the plans. Debris and loose material shall be removed. When completed, the average plane of the slopes shall conform to the slopes indicated on the plans and no point on the completed slopes shall vary from the designated plane by more than 6 inches measured at right angles to the slope, except where excavation is in rock no point shall vary more than 2 feet from the designated plane of the slope. In no case shall any portion of the slope encroach on the roadbed.

Tops of excavation slopes and ends of excavations shall be rounded as shown on the plans and these quantities will not be included in the quantities of excavation to be paid for. This work will be considered as a part of finishing slopes and no additional compensation will be allowed therefore.

Embankment slopes shall be finished in conformance with lines and grades shown on the plans. When completed the average plane of slopes shall conform to slopes indicated on the plans and no point on the completed slopes shall vary from the designated plane by more than 6 inches measured at right angles to the slope.

205.6 SURPLUS MATERIAL:

Unless otherwise shown on the plans, specified in the special provisions, or approved by the Engineer, no surplus excavated material shall be disposed of within the right-of-way. The Contractor shall make all arrangements for disposal of the material at off-site locations as may be approved by the Engineer, and shall upon request file with the Engineer the written consent of the owner of the property upon which he intends to dispose of such material.

If the quantity of surplus material is shown on the plans or specified in the special provisions, the quantity shown or specified is approximate only. The Contractor shall satisfy himself that there is sufficient material available for the completion of the embankments before disposing of any indicated surplus material inside or outside the right-of-way. Any shortage of material caused by premature disposal of surplus material by the Contractor, shall be replaced by him and no compensation will be allowed the Contractor for such replacement.

205.7 MEASUREMENT:

The following earthwork operations will be measured as roadway excavation for the quantities of material involved.

Excavating the roadway prism including public and private road approaches, connections and driveways; excavating unsuitable material when shown on the plans or specified in the special provisions; excavating slides and slipouts not resulting from overshooting; excavating surplus material; excavating selected material and topsoil from within the limits of project and removing such materials from stockpiles when stockpiling is ordered; excavating ditches and excavating borrow.

The Engineer will compute the quantities of material excavated by a method which in his opinion is best suited to obtain an accurate determination.

Excavation in excess of the planned or authorized cross-section will not be paid for, except as provided above. The Contractor shall backfill and compact unauthorized excavated areas to the original ground elevation of authorized section at no additional cost to the Contracting Agency.

Material resulting from excavating ditches or channels may be used to construct roadway embankments, dikes, or for other purposes, or disposed of, as directed by the Engineer.

Care shall be exercised to prevent excavating below the grade for the bottom of the ditch and areas excavated below grade shall be filled with suitable material and compacted by the Contractor at no additional cost to the Contracting Agency.

205.8 PAYMENT:

Quantities of roadway excavation will be paid for at the contract unit price per cubic yard. Such price shall include excavating, sloping, rounding tops and ends of excavations, loading, depositing, conditioning, spreading, and compacting the material complete in place and disposal of surplus material.

When the proposal does not include a pay item for roadway excavation the cost thereof shall be considered as being included in the price bid for the construction or installation of the items to which such roadway excavation is incidental or appurtenant.

- End of Section -

STRUCTURE EXCAVATION AND BACKFILL

206.1 DESCRIPTION:

Structure excavation shall consist of the removal of material for the construction of foundations for bridges, manholes, retaining walls, box culverts, head walls for culverts, and other structures, and other excavation designated on the plans or in these specifications or in the special provisions as structure excavation.

Structure backfill shall consist of furnishing material, if necessary, and placing and compacting backfill material around structures to the lines designated on the plans or specified or directed by the Engineer.

Structure excavation and structure backfill shall include the furnishing of all materials and equipment and the providing of other facilities which may be necessary to perform the excavations and place and compact the backfill, and the subsequent removal of these facilities, except where they are required or permitted by the plans, special provisions or Engineer to remain in place.

206.2 FOUNDATION MATERIAL TREATMENT:

When footing concrete or masonry is to rest upon rock, the rock shall be fully uncovered and the surface thereof shall be removed to a depth sufficient to expose sound rock. The rock shall be roughly leveled off or cut to approximate horizontal and vertical steps, and shall be roughened. Seams in the rock shall be grouted under pressure or treated as the Engineer may direct and the cost thereof will be paid for as extra work.

When no piles are used and footing concrete or masonry is to rest on an excavated surface other than rock, care shall be taken not to disturb the bottom of the excavation and final removal of the foundation material to grade shall not be made until just before the concrete or masonry is placed. Excavation below grade shall be replaced with the same class of concrete specified for the structure or with 1 ½ sack controlled low strength material as specified in Section 728. When the replacement material is structural concrete, the material shall be placed at the same time as the structure material. Placement of controlled low strength material shall be per Section 604 which will require a time lag between placement of the material and the structural concrete. The placement of the additional material shall be at no cost to the Agency except when over-excavation is directed by the Engineer.

The excavation for structures shall be completed to the bottom of the footings before any piles are driven therein, and excess material remaining in the excavation after pile driving shall be removed to the elevation of the bottom of the footings.

When piles are used and ground displacement results from pile driving operations, the Contractor shall at his expense excavate or backfill the footing area to the grade of the bottom of the footing as shown on the plans with structure backfill material.

206.3 INSPECTION:

When any structure excavation is completed, the Contractor shall notify the Engineer who will make an inspection of the excavation. No concrete or masonry shall be placed until the excavation has been approved by the Engineer.

206.4 STRUCTURE BACKFILL:

206.4.1 Preparation for Structure Backfill: Prior to the placement of structure backfill, the Contractor shall remove all loose, unstable materials from the sides of the structure excavation that may constitute a safety concern or impact proposed backfill operations. The Contractor shall then compact the bottom of the remaining open structure excavation to a uniform density of not less than 95 percent maximum dry density. With the approval of the compaction of the bottom of the open structure excavation by the Engineer, the Contractor may start the placement of the Structure Backfill.

206.4.2 Structure Backfill for Earth Retaining Structures: Structure Backfill to be placed against concrete structures designed to retain earth loads, such as bridge abutment backwalls and wingwalls, box culvert outside walls and wingwalls, and retaining walls:

(A) Shall conform to the material and the graduation requirements for Select Material, Type A or B in Table 702-1 unless otherwise approved by the Engineer.

(B) Shall not be placed until the concrete has reached its full design strength.

(C) Shall be placed in layers not more than 8 inches in depth before compaction, when compacted by pneumatic or mechanical tamping devices.

(D) Shall be uniformly compacted to at least 95 percent of maximum density.

EXCEPTION: Catch basins constructed in accordance with standard details and having the outlet invert depth equal to or less than six feet may place structure backfill when the concrete has attained a minimum compressive strength of 2500 psi in compression as specified in Section 725 and in no case less than 72 hours after casting.

206.4.3 Structure Backfill for Structures Other than Earth Retaining: Structure Backfill placed against concrete structures not designed to retain earth loads:

(A) Shall not be placed until the concrete has attained a minimum compressive strength of 2500 psi in compression as specified in Section 725 and in no case less than 72 hours after casting.

(B) Shall be uniformly compacted to at least 95 percent of maximum density.

206.4.4 Structure Backfill for Structures within Paved Areas: Where a structure is located within an existing street, proposed street, or paved area shall be compacted to the minimum density specified in Table 601-2, for Type I or shall be filled with ½ sack or 1 sack controlled low strength material as specified in Sections 604 and 728.

206.4.5 Structure Backfill for Precast Minor Structures: Minor structures, as defined in Section 505.1.1, when furnished as precast structures, shall be placed on a compacted layer of Structure Backfill at least 6 inches in depth that conforms to the material requirements of Section 206.4.2. The layer shall be shaped to fit the bottom surface of the precast unit and compacted to not less than 100 percent maximum density. The Structure Backfill shall be at or near optimum moisture content, as approved by the Engineer. After the unit has been initially set in place and checked for line and grade, it shall be removed, and any defects in its bearing area or line and grade shall be corrected by trimming and by placing and compacting similarly moistened Structure Backfill and the unit reset in place. If in the opinion of the Engineer the bearing area or line or grade of a set precast unit is defective, the Contractor shall remove the unit, correct the bearing area and reset the unit at no additional cost to the Agency. Precast units shall be installed on compacted, shape-conformed Structure Backfill in reasonable conformity with the lines and grades shown on the project plans.

206.4.6 Relative Compaction: Unless otherwise provided in the plans and/or special provisions the maximum density shall be determined using procedures defined in Section 301.

206.5 PAYMENT:

Unless otherwise provided in the special provisions or proposal, no payment will be made for structure excavation and backfill as such; the cost thereof shall be included in the contract price for the construction or installation of the items to which such excavation and backfill are incidental or appurtenant.

When the Special Provisions identify Structure Excavation and/or Structure Backfill as pay items, the following methods of measurement and payment shall be used:

206.5.1 Measurement

(A) **Structure Excavation:** Structure Excavation will be measured by the cubic yard, based on the volumes calculated from the measurement/pay limits shown on the Project Plans. If no limits are shown, the measurement for Structure Excavation shall be in accordance with the applicable details shown on the current Arizona Department of Transportation (ADOT) Standard Drawings B-19.30 and/or B-19.50.

No reduction in measurement for payment will be made when the Contractor elects to not excavate all material between the limits of the actual structure, and the pay limits shown on the Project Plans and/or the above referenced ADOT Standard Drawings.

No additional measurement for payment will be made for excavation resulting from lack of side support for structure excavations, nor due to carelessness of the Contractor.

(B) **Structure Backfill:** Structure Backfill will be measured by the cubic yard, based on the volumes calculated from the measurement/pay limits shown on the Project Plans. If no limits are shown, the measurement for Structure Backfill shall be in accordance with the applicable details shown on the current ADOT Standard Drawings B-19.40 and/or B-19.50.

206.5.2 Payment

Structure Excavation and Structure Backfill: The accepted quantities of Structure Excavation and the accepted quantities of Structure Backfill will be paid for at their respective contract unit prices.

Hauling, placing, and compacting surplus Structure Excavation in embankments, or otherwise disposing of the material, shall be included in the contract price paid for Structure Excavation.

- End of Section -

RIPRAP CONSTRUCTION

220.1 DESCRIPTION:

Riprap construction shall consist of furnishing and placing stone, with or without grout, and underlain with filter material of granular filter blankets or erosion control geosynthetic fabric. The depth and type of riprap shall be as shown on the plans or in the special provisions.

220.2 MATERIALS

Riprap shall conform to the requirements of Section 703.

Erosion control geosynthetic fabric shall conform to the requirements of Table 796-3 in Section 796.

Waste or sacked concrete shall not be permitted for use as riprap.

The Contractor, at no additional cost, shall provide mechanical equipment, a sorting site, and labor needed to assist in checking riprap gradation.

Granular filter blankets shall consist of processed natural material conforming to the requirements of Section 701, with the gradation and thicknesses as specified on the plans or in the special provisions.

220.3 PREPARATION OF GROUND SURFACES

The bed for placement of riprap shall be shaped and trimmed to provide even surfaces.

220.4 PLACEMENT OF EROSION CONTROL GEOSYNTHETIC FABRIC:

Fabric shall be placed at the locations shown on the project plans. The Contractor shall provide a surface free of obstructions, depressions, debris, and soft yielding surfaces prior to the placement of fabric. The fabric shall be loosely laid (not in a stretched condition), aligned and placed with no fold over wrinkles.

The fabric shall be placed to provide a minimum 24-inch of overlap for each joint. On horizontal joints, the uphill fabric shall overlap the downhill fabric. On vertical joints, the upstream fabric shall overlap the downstream fabric.

Bedding material shall be placed uniformly on the fabric to the depth specified on the plans and shall be free of mounds, dips, and windrows. Bedding material shall not be compacted.

220.5 RIPRAP PLACEMENT:

Riprap shall be carefully placed on filter material consisting of a granular filter blanket or the bedding material on erosion control geosynthetic fabric. Placement shall not damage the underlying filter blanket or geosynthetic fabric. If the Engineer determines that the placement of stone has damaged or displaced the filter material to the extent that it cannot function as intended, the Contractor, at his expense, shall remove the placed riprap stone and properly correct the damage to, and/or the displacement of, the filter material. Such correction may include the removal of the filter material, re-grading the affected area, and subsequent replacement of the filter material and riprap stone as required by the Engineer.

Riprap shall be placed in a manner which will produce a dense, reasonably well-graded mass without segregation and with a minimum amount of voids. The larger stone shall be evenly distributed through the riprap mass. The individual placement of larger riprap stones may be required to obtain a uniform distribution of stone size. The riprap placement shall be supplemented by such hand methods as are required to obtain a uniform finished surface. Allowable tolerance from the slope lines and grades shown for the finished riprap surfaces shall not exceed a distance equal to 1/3 of the nominal D_{50} size above or below the design surfaces. The final surface elevations shall be lower than any adjacent apron or pipe invert elevations and shall not obstruct the operation of adjacent structures. The flow line within riprap shall provide positive drainage with minimal ponding. Individual stones shall depress below the finished grades no lower than a distance equal to 1/2 of the nominal D_{50} size. Special care shall be exercised in placing riprap within 3 feet of structures to avoid damage to such structures.

220.6 GROUTED RIPRAP:

Place riprap as specified in Section 220.5, excluding the use of filter material and secure in place with Portland cement grout meeting the requirements of Table 220-1. Place grout to the depth as shown on the plan but in no case less than 70 percent of the depth of riprap. Consolidate grout into place with suitable spades, trowels or other approved means to provide a dense stone and mortar layer with all voids and interstices filled. After grout has been placed, the rocks shall be thoroughly brushed so that their top surfaces are exposed. If required, use water pressure to clean stone faces after the mortar has achieved sufficient strength. The outer rocks shall project 1/3 to 1/4 their diameter above the grouted surface.

TABLE 220-1
Grout for Riprap

Minimum Cementitious Material (lbs)	Maximum W/CM Ratio	Slump (in)	Air Content (%)
850	0.60	9 +/- 2	0 % - 8 %

The cementitious materials shall meet the requirements of Section 725.2. Up to 25 percent by weight of the Table 220-1 minimum cementitious materials requirements may be an approved fly ash or natural pozzolan. The aggregates shall meet the applicable requirements of ASTM C33, #8 (3/8") coarse aggregate grading and fine aggregate (sand) grading. All Ready Mixed Grout volume calculations shall be based on "absolute volume" with the total volume per cubic yard equal to 27 cubic feet. Coarse aggregate volume shall be a maximum of 35% of the total aggregates volume. All mixing shall be in accordance with the applicable requirements of Section 725.7.

The amount of slump shall be the minimum amount needed to permit gravity flow into the interstices with limited spading and brooming. The consistency of the grout shall be as approved by the Engineer.

220.7 MEASUREMENT:

The completed, in place riprap construction within the limits of the dimensions shown on the plans shall be measured. Measurement will be in cubic yards rounded to the nearest cubic yard.

No separate measurement will be made for erosion control geosynthetic fabric, bedding material, or grout.

220.8 PAYMENT:

Payment for riprap will be made for the accepted complete in-place riprap construction at the contract unit price. Riprap construction shall include excavation, ground surface preparation, erosion control geosynthetic fabric (if used for the project), bedding material, riprap stone, grout (if used for the project) and backfilling.

Payment for riprap shall be full compensation for furnishing all material, labor and equipment for riprap construction.

- End of Section -

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PLACEMENT AND CONSTRUCTION OF AGGREGATE BASE COURSE

310.1 DESCRIPTION:

Aggregate base course shall comply with Section 702 unless the use of a different type of material is specifically authorized in the special provisions.

310.2 PLACEMENT AND CONSTRUCTION:

The compacted lift thickness shall not exceed 6 inches, unless approved by the Engineer. Based on the type of material, type of equipment and compaction methods used, the Contractor may propose a greater lift thickness to the Engineer for approval.

After distributing, the aggregate base course material shall first be uniformly watered and then graded to a uniform layer that will net, after compacting, the required thickness. The grading operation shall be continued to such extent as may be necessary to minimize segregation. The quantity of water applied shall be that amount which will assure proper compaction resulting in the density required by Section 310.3.

After placement, the aggregate base course surface shall be true, even and uniform conforming to the grade and cross-section specified. In no case shall the aggregate base course vary by more than ½ inch above or below required grade.

310.3 COMPACTION

The contractor is responsible for providing appropriate equipment and techniques to achieve the compaction results required by this specification. The aggregate base course shall be compacted in lift thicknesses as allowed by Section 310.2.

The laboratory maximum dry density and optimum moisture content for the aggregate base course material shall be determined in accordance with AASHTO T-99. (Note: when testing base materials – use method “C” or “D” as required based upon the gradation of the material.) Field ‘one-point’ maximum dry density and optimum moisture procedures shall only be allowed upon approval of the Engineer.

The in-place density shall be determined in the field by nuclear density testing in accordance with AASHTO T-310 or sand cone density testing in accordance with AASHTO T-191. In the event nuclear density testing is selected, and density results are in question, a sand cone correlation will be performed by the accepting agency at the contractor’s request, not to exceed one sand cone for each ten nuclear density tests.

A rock correction, to compensate for rock content larger than the #4 or ¾ inch sieves (as required by the laboratory maximum dry density and optimum moisture procedure selected), shall be performed in accordance with AASHTO T-224. Care should be taken to account for the specific gravity of the oversize particles particularly if recycled materials are utilized for aggregate base course. The specific gravity shall be determined in accordance with ARIZ-227c, as applicable.

For roadway construction, a minimum of one field density test shall be performed per lift per 660 feet per lane. For other aggregate base course applications, a minimum of one field density test shall be performed for each 800 square yards.

Unless otherwise noted in the project plans or project specifications, the moisture content of the aggregate base course at the time of compaction shall be the optimum moisture content +/- 3%.

The following percent compaction is required:

(A) Below asphalt concrete pavement	100%
(B) Below Portland cement concrete pavement, driveways, curb & gutter, sidewalks, and roadway shoulders	95%
(C) All other areas not subject to vehicular traffic	85%

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Areas which fail initial testing for density and/or moisture content shall be reworked until passing tests for density and/or moisture content are achieved. Lower moisture content percentages at the time of field density testing may be allowed if significant time has passed since the time of compaction and the required density has been achieved.

310.4 THICKNESS AND/OR PLASTICITY INDEX DEFICIENCY:

When in the opinion of the Engineer there is reason to believe that a deficiency in thickness, or an excess of plasticity exists, measurements or samples will be taken in the same pattern as that defined in Section 321. If the base has been covered or it is otherwise impractical to correct the deficiency, the corrective measures in Table 310-1 shall be taken by the Contractor at no additional cost to the Contracting Agency.

TABLE 310-1

THICKNESS AND PLASTICITY DEFICIENCY

Type	Deficiency	Corrective Measure
I	Less than 1/2 inch of the required thickness	No corrective measure required.
II	1/2 inch or more but less than 1inch of the required thickness	(1) The contractor may choose to add additional material and rework the grade to meet the specification requirements. (2) The contractor may choose to increase the thickness of asphalt concrete by the amount of the aggregate base course thickness deficiency at no additional cost to the Owner. Required grade shall be met.
III	Thickness deficiency by greater than 1 inch	(1) The contractor will remove the aggregate base course and regrade the subgrade to allow the required aggregate base course layer thickness to be constructed. (2) If grades allow, the contractor may propose that the thickness of asphalt concrete be increased by the amount of the aggregate base course deficiency at no additional cost to the Owner.
IV	A plasticity index of 6 to 7 inclusive	(1) An Engineering Analysis (EA) that includes R-value testing may be prepared by the contractor to evaluate the expected performance of the aggregate base course layer. The EA may provide mitigation options for the Engineer to consider. If the Engineer accepts the plasticity index as a result of the EA, the material will be accepted at full payment. If the Engineer rejects the EA, the contractor will perform either option 2 or 3 below. (2) The contractor may choose to reprocess or treat the existing material to bring it within specification limits or remove deficient material from affected area and replace with material complying with the specifications. (3) If grades allow, the contractor may increase the thickness of asphalt concrete by ½-inch at no additional cost to the Owner.
V	A plasticity index of over 7	(1) The contractor may choose to reprocess or treat the existing material to bring it within specification limits or remove deficient material from affected area and replace with material complying with the specifications.

310.5 PAYMENT:

Payment for aggregate base course will be made on the basis of the contract unit price per ton unless an alternate basis of payment is provided in the proposal.

- End of Section -

PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

321.1 DESCRIPTION:

This section is to provide specifications for furnishing all materials, mixing at a plant, hauling and placing a mixture of aggregate materials, mineral admixture and asphalt binder to form a pavement course for placement upon a previously prepared base or sub base.

321.2 MATERIALS AND MANUFACTURE:

The materials shall conform to Section 710 for the type specified. Warm Mix Asphalt (WMA) technologies may be used within the mixture provided all requirements of the specifications are met, and the technology is on the ADOT approved product list. The specific required mix type shall be called out in the contract documents or as directed by the Engineer.

321.3 WEATHER AND MOISTURE CONDITIONS:

Asphalt concrete shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 40 degrees F. (50 degrees F for Asphalt Concrete lift less than 2 inch thick) or greater. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base or sub base on which the material is to be placed is unstable. Asphalt concrete shall be placed only when the Engineer determines that weather conditions are suitable.

321.4 APPLICATION OF TACK COAT:

A tack coat shall be applied to all existing and to each new course of asphalt concrete prior to the placing of a succeeding lift of asphalt concrete. If approved by the Engineer, the tack coat may be deleted when a succeeding layer of asphalt concrete is being applied over a freshly laid course that has been subjected to very little traffic.

The application of the tack coat shall comply with Section 329. The grade of emulsified asphalt shall be SS-1h or CSS-1h as specified in Section 713.

The same material that is specified above for the tack coat shall be applied to the vertical surfaces of existing pavements, curbs, and gutters, against which asphalt concrete is to be placed.

The surface to be covered may require repair or patching as directed by the Engineer. This shall be addressed in the project specifications prior to the bidding of the project.

321.5 MIX DESIGN:

The mix design shall be submitted to the Engineer at least five working days prior to the start of asphalt concrete production. Mix designs provided by the agency may be utilized on projects at the Engineer's discretion. The Engineer will review and approve the mix design to assure it contains all of the required information as outlined in Section 710.3.1. If WMA technologies are used within the mix design, the type of WMA technology used shall be indicated on the mix design. The target values for gradations, binder contents, and air voids will be established as the accepted Job Mix Formula (JMF) based upon the mix design. Mix designs not containing all of the information will be returned within five working days of receipt of all mix design information, for action and resubmission by the contractor.

Once the mix design has been approved by the agency and the mixing plant selected, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer.

If the contractor elects to change its source of material, the contractor shall furnish the Engineer with a new mix design, which meets the requirements of Section 710, as amended by the Project Specifications.

Revised 2015

The contractor may make self-directed target changes to the approved mix design within the limits shown below. Requests for self-directed target changes shall be made in writing and acknowledged by the Engineer prior to the start of production of a lot and will remain in effect until such time as any additional changes are implemented. The self-directed target changes must meet the contract requirements for mix design criteria and gradation limits.

TABLE 321-1
ALLOWABLE SELF-DIRECTED TARGET CHANGES

MEASURED CHARACTERISTICS	ALLOWABLE SELF-DIRECTED TARGET CHANGES
Gradation (Sieve Size)	
3/8 inch	± 4% from mix design target value
No 8	± 4% from mix design target value
No 40	± 2% from mix design target value
No 200	+0.5% from mix design target value
Binder Content	± 0.2% from mix design target value
Effective Air Voids	None

The contractor may propose target changes, other than self-directed changes, to the approved mix design for the approval of the Engineer. The Engineer will determine if the proposed target change will result in mix production that meets the contract requirements for mix design criteria and gradation limits. The target changes will not be retroactive for the purpose of acceptance.

321.6 MIX PRODUCTION:

All materials shall be proportioned by weight in a hot mix asphalt plant in the proportions required by the mix design to provide a homogeneous and workable mass. Each hot mix asphalt plant shall be inspected in accordance with the provisions contained in the 'Hot Mix Asphalt Production Facilities' by the Arizona Rock Products Association and shall have a current inspection certificate. All measuring devices shall be calibrated at least annually by a technician licensed by the Arizona Bureau of Weights & Measures. Mixing plants shall conform to the requirements of AASHTO M-156, except as modified herein. If WMA technology is being used, any equipment associated with the production of hot mix asphalt shall be calibrated and in proper working order according to the WMA equipment specifications. If there are any deviations in the production or compacting temperatures of the hot mix asphalt with WMA technology, the mix design shall state the differences.

In drum mix plants the mineral admixture shall be added and thoroughly mixed with the mineral aggregate by means of a mechanical mixing device prior to the mineral aggregate and mineral admixture entering the dryer. The moisture content of the combined mineral aggregate shall be a minimum of three percent by weight of the aggregate during the mixing process.

For drum-mix plants, the mineral admixture shall be weighed across a weight belt, or other approved alternative weighing system, with a weight totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer that is in good working condition. The rate of the aggregate feed shall not exceed the mixing device's capacity in ton per hour. The mixer shall be constructed to minimize the loss of mineral admixture and shall be located in the aggregate delivery system at a location where the mixed material can be readily inspected. The mixing device shall be capable of effective mixing in the full range of the asphalt concrete production rates.

The hot plant and equipment shall be constructed and operated to prevent loss of mineral admixture through the dust collection system of the plant.

A positive signal system shall be provided and used during production whereby the mixing shall automatically be stopped if the mineral admixture is not introduced into the mineral aggregate. The plant will not be permitted to operate unless the signal system is in good working condition.

The introduction of bituminous material shall be controlled by an automated system fully integrated with the controls or the mineral aggregate and mineral admixture. The production of the plant shall be controlled by the rate required to obtain a uniform mixture of all components. Drying and heating shall be accomplished in such a manner as to preclude the mineral admixture from becoming coated with un-spent fuel. The completed asphalt concrete may be held in storage for up to 12 hours in insulated or heated silos, providing the minimum temperature noted herein for placement and compaction is met behind the

placement device. If the Engineer determines that there is an excessive amount of heat, heat loss, drain down, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

The temperature of the asphalt concrete, with unmodified binders, upon discharge from the mixer shall not exceed 335 degrees F. The discharge temperature may be increased on the recommendation of the binder supplier, when approved by the Engineer. If the asphalt concrete is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the asphalt concrete will be minimized.

321.7 TRANSPORTATION:

Petroleum distillates or other substances that will have a detrimental effect on the asphalt concrete shall not be used as a release agent.

The beds of all transportation units shall be clean and smooth to allow the free flow of material into the paving machine's hopper.

Tarpaulins shall be furnished on all trucks and used when weather condition warrant, or if directed by the Engineer.

321.8 PLACEMENT:

Placement of asphalt concrete pavement shall not commence until authorized by the Engineer. The Engineer's authorization to allow commencement of asphalt concrete paving will generally require all newly constructed valley gutters, curbing, and curb and gutters which new pavement is to be placed against to be in-place and in an acceptable condition. While it is preferred to have all newly constructed concrete items against which new pavement is to be placed be in an acceptable condition, the Engineer may allow paving to commence based on weather, the amount of defective concrete, or other considerations.

321.8.1 Placing: All courses of asphalt concrete shall be placed and finished by means of a self-propelled paving machine equipped with an automatically actuated control system, except under certain conditions or at locations where the Engineer deems the use of a self-propelled paving machine impracticable.

The control system shall control the elevation of the screed at each end by controlling the elevation of one end directly and the other end indirectly either through controlling the transverse slope or alternatively when directed, by controlling the elevation of each end independently.

The control system shall be capable of working with one of the following devices:

(a) Ski or non-contact device of not less than 30 feet in length, supported throughout its entire length
(b) Taut stringline or wire set to grade
(c) Short ski or sonar sensing units from curb control
(d) Joint matching shoe

Failure of the control system to function properly shall be cause for the suspension of asphalt concrete production. In order to achieve a continuous operation, the speed of the paving machine shall be coordinated with the hot mix plant and transport units.

If the asphalt concrete is dumped from the hauling vehicles directly into the paving machine, care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machine by the truck.

If asphalt concrete is dumped upon the surface being paved and subsequently loaded in the paving machine, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the asphalt concrete shall be picked up and loaded into the paving machine.

Self-propelled paving machines shall spread the mixture without segregation or tearing, true to line, grade and crown indicated on the project plans. Pavers shall be equipped with hoppers and augers that will distribute the mixture uniformly in front of an adjustable floating screed. The raising of the hopper wings must be minimized and the paving machine will not be operated when in an empty condition.

Revised 2015

Screeds shall include any strike-off device operated by tamping or vibrating action which is effective, without tearing, shoving or gouging the mixture and which produces a course with a uniform texture and density for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required. In the case of the screed, auger extensions and vibrators shall be installed wherever the screed is extended more than one (1) foot beyond the end of the base auger or auger extension. However, when placing material against an extremely uneven curb or edge over a short distance, the Engineer may waive the auger extensions and vibrators.

At any place not accessible to the roller, the mixture shall be thoroughly compacted with tampers to provide a uniform and smooth layer over the entire area compacted in this manner.

321.8.2 Joints: Transverse joints, before a surface course is placed in contact with a cold transverse construction joint, the cold existing asphalt concrete shall be trimmed to a vertical face for its full depth exposing a fresh face. The fresh face shall be tack coated prior to placement of the new asphalt concrete. After placement and finishing the new asphalt concrete, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, parallel to the centerline.

Longitudinal joints of each asphalt course shall be staggered a minimum of 6 inches with relation to the longitudinal joint of the immediate underlying course's cold longitudinal construction joint.

Longitudinal joints with existing or cold (more than 32 hours old) asphalt concrete shall require the existing pavement to be trimmed to a vertical face for its full depth exposing a fresh face. The fresh face shall be tacked prior to placement of the adjacent course. Longitudinal joints with an existing asphalt pavement that is less than 32 hours old that has had its edge protected from damage may have adjacent new asphalt concrete placed after applying the required tack coat. After placement and finishing of longitudinal joints, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, in any direction.

321.8.3 Asphalt Leveling Course: A leveling course shall be used when specified, or as directed in writing by the Engineer, to bring existing pavement to a uniform grade prior to placing an overlay or other course. If a leveling course is being applied on an asphalt surface, a tack coat shall be applied. The compaction requirements contained in Section 321.10 do not apply to leveling courses.

321.8.4 Compaction; Asphalt Base Course and Surface Course: It is the contractor's responsibility to perform Quality Control monitoring and/or testing during compaction operations to achieve the required compaction. The temperature of the asphalt concrete immediately behind the laydown machine shall be at least 265 degrees F, unless WMA technology is being used. If WMA technology is being used then the minimum requirements will be stated within the mix design recommended by the WMA manufacturer. A probe type electronic thermometer with a current calibration sticker attached will be used to measure the temperature of the asphalt concrete mixture. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat. The contractor is responsible to achieve the required compaction.

Asphalt compaction equipment shall be of sufficient size and weight to accomplish the required compaction. All compaction equipment shall be operated and maintained in accordance with the manufacturer's recommendations and the project requirements. During the rolling operation, the speed of the roller shall not exceed three miles per hour, unless otherwise approved by the Engineer.

Pneumatic tired compactors shall be equipped with skirt-type devices mounted around the tires so that the temperature of the tires will be maintained during the compaction process.

The Engineer will determine the acceptability of the pavement compaction in accordance with Section 321.10.

321.8.5 Smoothness: The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway.

321.8.6 Asphalt Concrete Overlay: Asphalt concrete overlay consists of the placing and compacting plant mix asphalt concrete over existing pavement. The mix design and thickness of the overlay shall be as shown on the plans or as specified in the special provisions.

Except when the existing asphalt surface is to be preheated and remixed, pavement surfaces shall be prepared as follows:

(a) Areas designated for pavement repair by the contract documents (which may include severely raveled areas, severely cracked areas, over-asphalted areas, and other defects) shall be cut out and replaced. Pavement repairs shall be completed and approved before placing asphalt concrete overlay.

(b) Before placing asphalt concrete overlay, raised pavement markers shall be removed, and milling shall be completed. Milling shall be as shown on the plans or specified in the special provisions and shall be in accordance with Section 317.

(c) After pavement repairs and milling have been completed the entire surface shall be cleaned with a power broom.

(d) After surfaces have been prepared to the satisfaction of the Engineer, they shall receive a tack coat per Section 321.4. Traffic will not be permitted to travel over surfaces which have received a tack coat, except when tack coat is applied to milled surfaces in compliance with Section 317.2 for dust control purposes. When the overlay is to extend onto a concrete surface, the concrete surface shall be thoroughly cleaned of loose dust and cement particles and shall be tack coated.

Asphalt concrete overlay shall be placed as specified in Section 321.8.1 and compacted as specified in Section 321.8.4. The surface smoothness shall meet the tolerances specified in Section 321.8.5.

Frames and covers of manholes, survey monuments, valve boxes, clean-outs and other existing structures shall be adjusted in accordance with Section 345 to set flush with the finished surface of the new pavement. During adjustment, if pavement or base materials are removed or disturbed, they shall be replaced with approved materials installed in a manner acceptable to the Engineer.

On roads without curb and gutter, the existing unpaved shoulder elevation shall be adjusted by the Contractor to match the elevation at the edge of the new overlay and slope away from the new pavement surface at a rate that the existing quantity of shoulder material will allow. Shoulder material shall be compacted to a minimum of 95% of maximum density, determined in accordance with Section 301.3. Shoulder adjustment to match the new pavement surface elevation shall not be measured. The cost of shoulder adjustment shall be included in the price paid for the asphalt concrete overlay or other related pay items. When the Engineer determines an insufficient amount of material is available for shoulder adjustment, the Engineer may require the Contractor to provide additional material. Acceptable material for shoulders includes the existing shoulder material, millings, untreated base materials, or a granular material approved by the Engineer. Engineer requested imported material for shoulder adjustment is not included in the price paid for the asphalt concrete overlay.

321.8.7 Pavement Fabric Interlayer: Pavement fabric interlayer shall be used only when specified on the plans or in the specifications.

Pavement fabric interlayer shall be in accordance with Table 796-1 and be the class designated on the plans or in the specifications.

Asphalt binder coat used to bond the fabric to the pavement shall be paving asphalt PG 70-10 asphalt cement conforming to the requirements of Section 711. The application and distributing equipment for the asphalt binder shall conform to the requirements of Section 330. The asphalt binder coat shall be uniformly spray applied to the prepared pavement surface at the rate of 0.20 gallons per square yard for Class B fabric or at the rate of 0.25 gallons per square yard for Class A fabric. Some underlying surfaces may require a higher or lower application rate. A test strip may be necessary to determine the proper application rate. The width of liquid asphalt cement application shall be the fabric width, plus six inches.

Neither the asphalt binder coat or fabric interlayer shall be placed when weather conditions, in the opinion of the Engineer, are not suitable. The asphalt binder and fabric interlayer shall only be placed when the pavement is dry, the ambient air temperature is 50 degrees F and rising, and pavement temperature is 40 degrees F and rising.

Equipment for placing the fabric shall be mechanized and capable of handling full rolls of fabric. The equipment shall be able to lay the fabric smoothly to maximize pavement contact and remove air bubbles. Stiff bristle brooms shall be used to smooth the fabric. The equipment used to place the fabric shall be in good working order and is subject to approval by the Engineer.

Pavement fabric interlayer shall not be placed if the in-place binder is hotter than 325 degrees F or has cooled to 180 degrees F or below (as determined by non-contact thermometer).

Pavement fabric interlayer shall be placed onto the asphaltic binder with the heat bonded side up with a minimum amount of wrinkling or folding. Remaining wrinkles or folds 1-inch and larger shall be removed or slit and shingle-lapped in the direction of paving. Burning or torching of wrinkles is not allowed. Fabric shall overlap three to six inches to insure full closure of the joint. Transverse joints shall be shingle-lapped in the direction of paving to prevent edge pickup by the paver. A second application of hand-placed asphalt binder may be required at laps and repairs as determined by the Engineer to ensure proper binding of the narrow double fabric layer.

All areas where fabric has been placed shall be paved with asphaltic concrete during the same workshift. Placement of the asphaltic concrete shall closely follow fabric lay down. The temperature of the asphaltic concrete immediately behind the laydown machine shall not exceed 325 degrees F, unless modified by the WMA technology being used. If WMA technology is being used then the minimum requirements will be stated within the mix design recommended by the WMA manufacturer. In the event that the asphalt binder coat bleeds through the fabric causing construction problems before the overlay is placed, the affected areas shall be sanded with a sand blotter in compliance with Section 333. Excess sand shall be removed before beginning the paving operation. In the event of rainfall prior to the placement of the asphaltic concrete, the fabric shall be allowed to dry before the asphalt concrete is placed.

Turning of the paving machine or of other vehicles on the fabric shall be gradual and kept to a minimum to avoid damage to the fabric. Should equipment tires stick to the fabric during pavement operations, small quantities of paving asphalt concrete shall be broadcast on the fabric to prevent pick-up. Decrease of binder rate in order to minimize pick-up on tires is not allowed.

321.8.8 Thickened Edge: When the depth of the thickened edge extends four inches or more below the bottom of the asphalt pavement, the portion of the thickened edge extending below the asphalt pavement shall be placed and compacted prior to placement of the asphalt pavement. Placement of tack coat on the surface of the compacted thickened edge asphalt may be omitted when additional asphalt pavement is placed on the same day and the Engineer agrees that the surface of the thickened edge asphalt has remained clean.

When the depth of the thickened edge extends less than four inches below the bottom of the asphalt pavement, the portion below the asphalt pavement may be placed and compacted with the asphalt pavement in a single operation.

321.8.9 Safety Edge: The finished safety edge slope shall be planar forming a 30° ± 5° angle with the adjacent roadway surface and extend a minimum of five inches (5”) below the roadway pavement’s finished surface.

The safety edge shall be constructed with the top or final paving lift of a new pavement or overlay using a device that is mounted to or is a part of the screed portion of the laydown machine. The safety edge device shall be capable of constraining the asphalt concrete material to increase density of the extruded profile by reducing the volume. A conventional single strike-off plate is not acceptable. Compaction obtained from the extruded safety edge shall be acceptable when the extruded shape conforms to the specified shape.

During laydown operations if the extruded safety edge does not conform to the specified shape, the Contractor shall take immediate actions to correct the deficiency and to repair all non-compliant sections of safety edge. The Contractor shall stop paving operations until corrections to the laydown operation have been made and resumption of paving is approved by the Engineer or his designated representative.

321.8.10 Protection for Asphalt Base Course: Arterial roadway traffic shall not be allowed on a new asphalt base course that is less than five inches (5”) in thickness without the written consent of the Engineer.

321.9 QUALITY CONTROL:

It is the contractor’s responsibility to perform Quality Control monitoring and/or testing during asphalt concrete production to achieve the required compaction and to perform Quality Control monitoring and/or testing during asphalt concrete production to achieve the required mix properties. The Engineer may obtain samples of any portion of any material at any point of the operations for his own use. Also, the Engineer may order the use of any drying, proportioning and mixing equipment or the handling of any material discontinued which, in his/her opinion, fails to produce a satisfactory mixture.

The asphalt concrete produced shall conform to the requirements of the production tolerances established in Section 321.10. When the asphalt concrete does not conform to the production tolerances, it shall be reported to the Engineer, and corrective quality control measures shall be implemented, or production shall cease immediately at no additional cost to the contracting Agency.

Requests for referee testing as described in Section 321.11 will only be considered based on quality control test results performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories for the set of tests in question. The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).

321.10 ACCEPTANCE:

321.10.1 Acceptance Criteria: Asphalt concrete will be divided into lots for the purpose of acceptance. A lot shall be one day's production. Each lot shall be divided into sublots of 500 ton or fraction thereof. Tests used to determine acceptance will be performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed. The contracting agency shall provide an appropriately accredited laboratory or laboratories to perform the acceptance testing. laboratories shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). The acceptance laboratory will take representative samples of the asphalt concrete from each sublot to allow for testing of gradation, binder content, air voids, pavement thickness, and compaction of base and surface courses. Acceptance of each sublot will be based on the test data from the sample(s) from that sublot. All acceptance samples shall be taken using random locations or times designated by the Engineer in accordance with ASTM D3665.

321.10.2 Gradation, Binder Content and Air Voids: The acceptance laboratory will take a sample of the asphalt concrete in accordance with the requirements of Section 2 or 4 of Arizona Test Methods 104 or AASHTO T-168 from each sublot. The minimum weight of the sample shall be 45 pounds. Asphalt binder content and gradation shall be determined in accordance with AASHTO T-308 using the ignition furnace for each sublot. The acceptance laboratory is responsible for obtaining the necessary materials and performing an ignition furnace calibration as outlined in AASHTO T-308 for each asphalt concrete mixture utilized on the project. The correction factor used for each test shall be clearly indicated on the report. The bulk density for Marshall Mix designs shall be tested in accordance with AASHTO T-245. The bulk density for Gyratory mix designs shall be determined in accordance with AASHTO T-312. The maximum theoretical density shall be determined in accordance with the requirements of AASHTO T-209 including fan drying per AASHTO T-209 Section 15. Effective voids of the laboratory compacted specimens will be determined at a minimum of once per lot in accordance with the requirements of AASHTO T-269. Should the testing for effective air voids not meet the "Full Payment" or "No Corrective Action" requirements of Table 321-5, additional testing for laboratory air voids on the remaining sublots will be performed as necessary to determine the extent of the deficiency. Acceptance testing results will be furnished to the contractor and the supplier within five working days of receipt of samples by the acceptance laboratory.

During production, the allowable deviations from the mix design gradation targets are listed in the tables below. The allowable production tolerances may fall outside of the mix design gradation bands.

TABLE 321-3A
GRADATION ACCEPTANCE LIMITS FOR MARSHALL MIXES

Sieve Size	3/8 inch Mix	1/2 inch Mix	3/4 inch Mix	Base Mix
1 inch	---	---	---	±7%
3/4 inch	---	---	±7%	±6%
1/2 inch	---	±7%	---	---
3/8 inch	±7%	±6%	±6%	±6%
No. 8	±6%	±6%	±6%	±6%
No. 40	±4%	±4%	±4%	±4%
No. 200	±2%	±2%	±2%	±2%

TABLE 321-3B GRADATION ACCEPTANCE LIMITS FOR GYRATORY MIXES			
Sieve Size	3/8 inch Mix	1/2 inch Mix	3/4 inch Mix
3/4 inch	---	---	±7%
1/2 inch	---	±7%	±6%
3/8 inch	±7%	±6%	---
No. 8	±6%	±6%	±6%
No. 40	±4%	±4%	±4%
No. 200	±2%	±2%	±2%

If the results from a single acceptance sample fall outside of the acceptance limits in Table 321-3A or 321-3B as applicable, a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits the Contractor shall cease production of asphalt concrete. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in Table 321-3A or 321-3B as applicable.

If the asphalt binder content is within ± 0.40% of the mix design target value, the asphalt concrete will be paid for at the contract unit price. If the asphalt binder content deviates by more than ± 0.40% from the mix design target value, the deficient area will be evaluated within the sublot by coring one additional location at a maximum interval of 100 feet on each side of the deficient sample. The asphalt content of the original deficient sample will be averaged with the asphalt binder content of the two additional cores to determine compliance with the acceptance requirements. If the resulting average of the asphalt binder content deviates by more than ± 0.40% from the mix design target value, then Table 321-4 shall apply to the sublot. If approved by the Engineer, the Contractor may obtain additional cores to assist in formulation of an Engineering Analysis, but the additional cores shall not be used for re-evaluating acceptance.

TABLE 321-4 ASPHALT BINDER CONTENT ACCEPTANCE AND PENALTIES		
Deviation from that permitted	When the contracting agency is the owner: Payment Reduction ($ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
Over 0.2% above that permitted	Removal* or EA	Removal* or EA
Over 0.1% to 0.2% above that permitted	$6.00	EA
Over 0.0% to0.1% above that permitted	$2.00	EA
Within permitted range	Full Payment	No Corrective Action
Over 0.0% to0.1% below that permitted	$2.00	EA
Over 0.1% to 0.2% below that permitted	$6.00	EA
Over 0.2% below that permitted	Removal* or EA	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire sublot that is deficient.
EA = Engineering Analysis per Section 321.10.6

If the laboratory air voids fall within a range of 2.8% to 6.2%, the asphalt concrete will be paid for at the contract unit price. If the laboratory air voids are outside of this range, the deficient area will be evaluated within the sublot by coring one additional location at a maximum interval of 100 feet on each side of the deficient sample. The laboratory air voids of the original deficient sample will be averaged with the laboratory air voids obtained from each of the two additional cores to determine compliance with the acceptance requirements. If the resulting average of the laboratory air voids is outside the indicated range, then Table 321-5 shall apply to the sublot. If approved by the Engineer, the Contractor may obtain additional cores to assist in formulation of an Engineering Analysis, but the additional cores shall not be used for re-evaluating acceptance.

TABLE 321-5 LABORATORY VOIDS ACCEPTANCE AND PENALTIES		
Laboratory Air Voids (Measured at N_{des} or 75 blows as applicable)	When the contracting agency is the owner: Payment Reduction ($ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
Less than 1.5%	Removal* or EA	Removal* or EA
1.5-2.0%	$5.00	EA
2.1-2.7%	$2.00	EA
2.8-6.2%	Full Payment	No Corrective Action
6.3-6.9%	$2.00	EA
7.0-8.0%	$5.00	EA
Greater than 8.0%	Removal* or EA	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire sublot that is deficient.
EA = Engineering Analysis per Section 321.10.6

If an agency or Engineer is purchasing asphalt concrete directly from a commercial material supplier, the agency or Engineer will use Section 321.10, and specifically Tables 321-3A or 321-3B as applicable, 321-4 and 321-5 from Section 321.10, when determining the acceptance of the asphalt concrete with the material supplier.

321.10.3 Surface Testing: If directed by the Engineer surface drainage test shall be performed. The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway. The straightedge shall be furnished by the contractor and shall be acceptable to the Engineer.

All streets shall be water tested for drainage in the presence of the Engineer or designated representative before final acceptance. Any areas not draining properly shall be corrected to the Engineer's satisfaction at the Contractor's expense. Water for this testing shall be provided and paid for by the Contractor.

When deviations in excess of the above tolerance are found, humps or depressions shall be corrected to meet the specified tolerance. The defective pavement shall be cut out along neat straight lines or for multiple course pavements the surface course may be milled out, and the removed pavement replaced with fresh hot mixture and thoroughly compacted to conform with and bond to the surrounding area. Materials and work necessary to correct such deviations shall be at no additional cost to the Contracting Agency.

When pavement is cut out along neat straight lines, full depth longitudinal joints shall not be located within a lane wheel path or within forty-eight inches (48") of an asphalt pavement edge. Longitudinal joints shall comply with the restrictions for Type A Trench Repairs in Section 336.3.

321.10.4 Asphalt Pavement Thickness: Asphalt pavement thickness will be determined from cores secured from each lift of each sublot. Such cores will be taken and measured by the Asphalt Concrete Coring Method. This method can be found in Section 321.14. Each core location will be patched by the party responsible for the testing.

Acceptance or assessment of penalties for asphalt pavement thickness will be based on the combined total thickness of all asphalt concrete layers omitting all layers of asphalt-rubber asphalt concrete. If the final total pavement thickness exclusive of all ARAC layers is deficient from the target thickness by 0.25 inches or less, it will be paid for at the contract unit price.

Revised 2016

If the thickness deficiency of the pavement core exceeds 0.25 inch, the thickness deficiency shall be evaluated by coring at a maximum interval of 100 feet on each side of the deficient core. The thickness of the original deficient core will be averaged with the thicknesses of the cores taken from each side of it to determine compliance with the acceptance requirements.

If the pavement thickness deficiency is greater than 0.25 inches and the contracting agency is not the owner (i.e. permits) the following will apply:

(1) If the pavement thickness deviates from the target thickness by more than 0.25 inch but not more than 0.50 inch, corrective action will be required. This corrective action shall consist of application of a Type II slurry seal coat in accordance to Section 715. The Contractor may present an Engineering Analysis outlining other proposed remedial measures for the consideration by the Engineer. The Engineer will review the engineering analysis and decide within 30 working days whether to accept the proposed remedial measures.

(2) If the pavement thickness deviates from the target thickness by more than 0.50 inch, corrective action will be required. The deficient area shall be overlaid with no less than a 1 inch thick lift, for the full width of the pavement to meet or exceed the designed thickness, with appropriate end and edge milling, with a mixture approved by the Engineer. The Contractor may present an engineering analysis outlining other proposed remedial measures for the Engineer's consideration. The Engineer will review the engineering analysis and decide within ten working days whether to accept the proposed remedial measures. If the Engineer chooses to reject the Engineering Analysis, the indicated overlay shall be constructed by the Contractor at no additional cost to the Owner.

If the contracting agency is the owner and the pavement thickness deficiency is greater than 0.25 inches but less than 0.50 inches, Table 321-6 will apply. If the pavement thickness deficiency is greater than 0.5 inches, the deficient area shall be overlaid with no less than a 1-inch thick lift for the full width of the pavement to meet or exceed the designed thickness using an asphalt mixture approved by the Engineer. The Contractor shall provide appropriate end and edge milling. The overlay and milling shall be accomplished by the Contractor at no additional cost to the contracting agency.

TABLE 321-6

ASPHALT PAVEMENT THICKNESS PAYMENT REDUCTION
For Thickness Deficiency of More Than 0.25 inches and less than 0.50 inches

Total Specified Asphalt Pavement Thickness exclusive of ARAC (if any)	**Reduction in Payment Applied to asphalt concrete Except ARAC layers (if any)**
Less than 1.5 inches	50%
1.50 inches to 1.99 inches	33%
2.00 inches to 2.49 inches	25%
2.50 inches to 2.99 inches	20%
3.00 inches and greater	17%

321.10.5 Density:

321.10.5.1 Pavement 1-1/2 Inches or Less in Nominal Thickness:

Compaction shall consist of a "Rolling Method Procedure" using an established sequence of coverage with specified types of compactors. A pass shall be defined as one movement of a compactor in either direction. Coverage shall be the number of passes as are necessary to cover the entire width being paved.

The rolling sequence, the type of compactor to be used, and the number of coverages required shall be as shown in Table 321-7.

TABLE 321-7				
ROLLING SEQUENCE FOR LIFT THICKNESS 1½" OR LESS				
Rolling Sequence	**Type of Compactor**		**No. of Coverages**	
	Option No. 1	**Option No. 2**	**Option No. 1**	**Option No. 2**
Initial	Static Steel	Vibrating Steel	1	1
Intermediate	Pneumatic Tired	Vibrating Steel	4	2- 4*
Finish	Static Steel	Static Steel	1-3	1-3
* Based on the roller pattern which exhibits the best performance.				

The Contractor shall select the option for compaction and, when pneumatic-tired compactors are used will designate the tire pressure. Steel wheel compactors shall not be used in the vibratory mode for courses of one inch or less in thickness nor when the temperature of the asphaltic concrete falls below 180 degrees F. Initial and intermediate compaction shall be accomplished before the temperature of the asphaltic concrete falls below 200 degrees F.

Compaction will be deemed to be acceptable on the condition that the asphaltic concrete is compacted using the type of compactors specified, ballasted and operated as specified, and with the number of coverages of the compactors as specified.

321.10.5.2 Pavement Greater than 1-1/2 Inches in Nominal Thickness:

Achieving the required compaction is the responsibility of the contractor. The number and types of rollers is the contractor's responsibility and shall be sufficient to meet these requirements.

In-place air voids shall be determined in accordance with AASHTO T-269 utilizing cores taken from the finished pavement. The maximum theoretical density used in the determination of in-place air voids will be the average value from the acceptance samples determined for the lot as outlined in 321.10.1.

The Engineer will designate one random test location for each sublot and the acceptance laboratory will obtain one core from that location. Regardless of sublot quantities or boundaries, a minimum of one core will be obtained per residential street and a minimum of one core per travel lane for collector and arterial streets. The outside one foot of each pass of the pavement course or any unconfined edge will be excluded from testing. The Engineer may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

The Contractor shall provide the traffic control to facilitate any coring operations necessary for compaction acceptance.

Cores will be taken per the Asphalt Concrete Coring Method. This method can be found in Section 321.14. Acceptance testing results will be furnished to the contractor within five working days of receipt of samples by the acceptance laboratory.

If the pavement density has in-place voids of between 4.0% and 8.0%, the asphalt concrete will be paid for at the contract unit price. If the acceptance core for a sublot indicates that the pavement density has in-place voids of less than 4.0% or greater than 8.0%, the deficient area will be evaluated by coring two additional locations at maximum intervals of 100 feet from the deficient core. The in-place voids of the original deficient core will be averaged with the in-place voids of the cores taken from 100 feet on each side of it to determine compliance with the acceptance requirements. If the resulting average of the in-place voids is outside the indicated range, then Table 321-8 shall apply to the sublot. If approved by the Engineer, the Contractor may obtain additional cores to assist in formulation of an Engineering Analysis, but the additional cores shall not be used for re-evaluating acceptance.

TABLE 321-8		
PAVEMENT DENSITY PENALTIES		
Limits of In-place Air Voids for design lift thicknesses 1.5 inches and greater	When the contracting agency is the owner Payment Reduction ($ per ton of asphalt concrete)	When the contracting agency is not the owner i.e. permits Corrective Action
Below 3.0%	Removal* or EA	Removal* or EA
3.0% to below 4.0%	$10.00	EA and Type II Surry Seal
4.0% to 8.0%	Full Payment	No Corrective Action
Greater than 8.0% to less than 9.0%	$6.00	EA
9.0% to 10.0%	$10.00	EA and Type II Surry Seal
Greater than 10.0%	Removal* or EA	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire sublot that is deficient.
EA = Engineering Analysis per Section 321.10.6

321.10.6 Engineering Analysis (EA): Within 10 working days after receiving notice that a lot or sublot of asphalt concrete is deficient and is found to fall within the "Removal or EA" band per Table(s) 321-4, 321-5, and/or 321-8 the contractor may submit a written proposal (Engineering Analysis) to accept the material in place at the applicable penalties along with possible remediation(s) listed in the "Removal or EA" category. Engineering Analysis can also be proposed for non-removal categories of "Corrective Actions" when the contracting agency is not the owner (i.e. permits).

The Engineering Analysis shall contain an analysis of the anticipated performance of the asphalt concrete if left in place. The Engineering Analysis shall also detail the effect of any proposed corrective action to the material(s) in place as it relates to the in-place material's performance. The Engineering Analysis shall be performed by a professional engineer experienced in asphalt concrete testing and mix designs.

If a lot or sublot is accepted for referee testing and the referee test results still show a deficiency, the contractor shall have ten working days to submit an Engineering Analysis beginning upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or sublot should not be removed, the Engineering Analysis will recommend that the following penalties (Table 321-9) be paid when the contracting agency is the owner, for the specific criteria being reviewed by the EA.

TABLE 321-9		
ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE		
Acceptance Criteria	**Acceptance Limits**	**Penalty When Contracting Agency is the Owner ($/Ton)**
Asphalt Binder Content	Over 0.2% points from that Permitted	$9.00
Laboratory Air Voids (Measured at N_{des} or 75 blows as applicable)	Less than 1.5% or Greater Than 8.0%	$7.50
Limits of In-place Air Voids	Less than 3% or Greater than 10.0%	$15.00

Within 15 working days, the Engineer will determine whether or not to accept the contractor's proposed Engineering Analysis.

321.11 REFEREE:

If the Contractor has reason to question the validity of any of the acceptance test results, the Contractor may request that the Engineer consider referee test for final acceptance. Any request for referee testing must describe the contractor's reasons for questioning the validity of the original acceptance test results and must clearly describe which set of acceptance tests are in question. The engineer may either accept or reject the request for referee testing. When referee testing is accepted the Contractor (at the Contractors own expense) will engage an independent laboratory accredited by the AAP or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories as appropriate the acceptance tests that are being questioned. The independent referee laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). For the set of test results in question the referee laboratory shall perform a new set of acceptance tests (as required by Section 321.10 representing the area for the set of tests in question). The referee tests will replace the original acceptance tests that were in question.

These tests may include asphalt binder content, aggregate gradation, Marshall or Gyratory unit weight, maximum theoretical unit weight, laboratory air voids and in-place air voids (compaction). Samples for referee testing shall come from representative samples obtained from the completed pavement, as directed by the Engineer.

The number of samples taken will be the same as specified in Section 321.10. The independent laboratory shall compile the test results and transmit them to both the Engineer and the contractor. The independent laboratory shall include a report sealed and signed by an Engineer registered in the State of Arizona, who is experienced in asphalt concrete testing and mix design development. The signed report shall give an opinion that the material evaluated does or does not comply with project specifications, shall clearly describe any deficiencies, and the results will be binding between all parties.

321.12 MEASUREMENT:

Asphalt concrete pavement will be measured by the ton, or by the square yard, for the mixture actually used as allowed above, which shall include the required quantities of mineral aggregates, asphalt binder, and mineral admixture. Measurement shall include any tonnage used to construct intersections, roadways, streets, or other miscellaneous surfaces indicated on the plans or as directed by the Engineer.

Measurement for safety edge preparation only applies to overlays of existing pavements that require the construction of a safety edge when none exists. Safety edge preparation will be measured by the linear foot. Safety edge preparation will not be measured when a safety edge is part of new pavement construction, pavement widening, or when overlaying an existing pavement that contains a safety edge. The asphalt concrete pavement measurement shall include the tonnage used to construct safety edges or the square yard measurement for asphalt concrete pavement will be increased by the horizontal extension of the safety edge beyond the roadway pavement edge.

321.13 PAYMENT:

The asphalt concrete measured as provided above will be paid for at the contract price per ton or square yard, as adjusted per Section 321.10, which price shall be full compensation for the item complete, as herein described and specified.

Payment for tack coat will be by the ton diluted, based on the rate of application, as directed by the Engineer.

No payment will be made for any overrun in quantity of asphalt concrete in excess of 10 percent for newly constructed pavement having a total thickness equal to or greater than 2.5 inches. The overrun quantity is excess tonnage above the tonnage calculated based on actual field measurement of area covered, design thickness, and the mix design unit weight. The calculations for overrun will be by individual pay item. To compensate or adjust for a thickness deficiency in an underlying asphalt concrete course, the Engineer may authorize a quantity increase in excess of 10 percent for a subsequent asphalt concrete course. In such cases, the quantity in excess of 10 percent will be paid for at the lowest unit price.

Removal of raised pavement markers, pavement repars, and surface pavement replacments required prior to roadway overlay operations will be paid for by other pay items unless otherwise specified.

Revised 2016

Except as otherwise specified, no separate payment will be made for work necessary to construct thickened edges, safety edges, or other miscellaneous items or surfaces of asphalt concrete.

Payment for safety edge preparation will be at the contract unit price for the quantities measured as described above.

321.14 ASPHALT CORE METHOD: Core Drilling of Hot Mix Asphalt (HMA) for Specimens of 4" or 6" diameter

321.14.1 Scope: This method is to establish a consistent method of the use of a diamond bit core to recover specimens of 4 or 6 inch diameter for laboratory analysis and testing. The method will require the use of: water, ice (bagged or other suitable type), dry ice, and a water-soap solution to be utilized when coring asphalt rubber concrete. Individuals doing the specimen recovery should be observing all safety regulations from the equipment manufacturer as well as the required job site safety requirements for actions, and required personal protective equipment.

321.14.2 Core Drilling Device: The core drilling device will be powered by an electrical motor, or by an acceptable gasoline engine. Either device used shall be capable of applying enough effective rotational velocity to secure a drilled specimen. The specimen shall be cored perpendicularly to the surface of pavement, and that the sides of the core are cut in a manner to minimize sample distortion or damage. The machinery utilized for the procedure shall be on a mounted base, have a geared column and carriage that will permit the application of variable pressure to the core head and carriage throughout the entire drilling operation. The carriage and column apparatus shall be securely attached to the base of the apparatus; and the base will be secured with a mechanical fastener or held in place by the body weight of the operator. The core drilling apparatus shall be equipped with a water spindle to allow water to be introduced inside of the drill stem while operating. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with embedded diamond chips in the cutting surface. The core barrel shall be of sufficient diameter to secure a specimen that is a minimum of four or six inches or whichever is prescribed for necessary testing. The core barrel shall not be missing more than one of the teeth used for cutting; if so it shall be discarded and another barrel shall be used. The core barrel shall also be a minimum of two inches longer than the anticipated depth of pavement in accordance with project paving plans.

321.14.3 Accessory Equipment: A sufficient supply of ice and dry ice shall be provided to sufficiently cool the pavement prior to securing the samples from the designated areas in the pavement. The ice should also be used to adjust the temperature of the water used to cool the core bit. A water supply (usually a plastic 35 – 55 gal drum) with sufficient hose to introduce the water into and through the spindle of the coring device by gravity feed. The drum should be white or light in color to minimize excessive thermal heating of the water (*for coring of asphalt rubber cores see Note 1*). At no time shall the water utilized in the coring operation exceed 65 degrees F during the coring operation. Ice shall be utilized to ensure the temperature control of the water being introduced during the cutting operation. An ice chest or other suitably insulated container that can maintain a temperature of less than 70 degrees F shall be used to secure the specimens during transport. The container will be equipped with flat shelving that will support the drilled cores throughout the entire specimen dimension during transport back to the testing facility.

Miscellaneous hand tools to remove the drilled specimen from the drill hole or the core barrel taking great care in not disturbing the specimen more than necessary (refer to fig. 1 in ASTM D5361).

321.14.4 Process: The pavement surface at the time of coring shall not exceed a temperature of 90 degrees F; the pavement shall be conditioned with ice or dry ice to ensure that this requirement is met. Immediately after it has been ensured that the pavement has dropped to the required temperature, core drilling shall begin. The operator will then apply an even and continuous pressure (Note 2) to penetrate through the full depth of the pavement. The operator will concurrently ensure that enough water is moving over the core surface as to adequately remove any and all cuttings that could damage the drilled core. After the pavement thickness has been penetrated the core shall be carefully removed from either the drill hole or the core barrel and be immediately transferred to an ice chest or other suitable container. Each individual core shall be placed on a shelf in the cooler with the exposed side of the specimen facing down, or the "top side" down. If the specimen is a two lift core, the only acceptable means of separating lifts is with a power or other acceptable wet saw type of equipment (conforming to ASTM D5361); however, at no time shall cores be split using a mallet and screwdriver or metal straight edge when being tested for bulk density. Perpendicularity of the specimen shall be checked in the field after the specimen has been extracted from the surface. The core operator shall hold the core up to eye level and place the core top side down in a "speed square" or small carpenters square. The specimen placed in the square shall not depart from perpendicular to the axis more than 0.5^{o} (approximately equivalent to 1/16 of an inch in 6 inches). If the specimen is outside of this distance from square it shall be discarded in the field and another sample cored that falls within tolerance. The cores upon arriving at the laboratory for testing shall be carefully cleaned and measured for thickness in accordance with ASTM D3549. A speed square shall be utilized to

measure perpendicularity as compared to a 90 degrees angle and shall not depart from perpendicular to the axis more than 0.5 degrees (approximately equivalent to 1/16 of an inch in 6 inches). All remaining testing shall be done within the parameters of the current project and/or agency required specification.

*Note 1 – It should be noted that when the material to be cored is a rubberized asphalt mixture a wetting agent such as liquid dish soap shall be added to the water barrel to hinder the material from sticking or allowing the binder to spread during coring.
*Note 2 – This refers to pressure exerted on the core barrel and machine during the coring process. Too much pressure can cause damage to the core barrel and the motor; and too little pressure can cause a glazing of the diamonds, reducing cutting efficiency and premature wear of the barrel.

-End of Section-

TACK COAT

329.1 DESCRIPTION:

Tack coat for bituminous paved surfaces shall consist of the application of emulsified asphalt as specified in Section 713.

329.2 PREPARATION OF SURFACE:

Surfaces to be treated shall be cleaned of all loose material as specified in Section 330.

329.3 APPLICATION:

Tack coat shall be diluted in the proportion of 50 percent water and 50 percent emulsion and applied at the rate of 0.05 to 0.10 gallons per square yard. Application shall be made in advance of subsequent construction as ordered by the Engineer.

329.4 EQUIPMENT:

Tack coat shall be applied by distributor trucks designed, equipped, maintained and operated in accordance with Section 330. Hand spray by means of hose or bar through a gear pump or air tank shall be acceptable for resurface work, corners or tacking of vertical edges. Care shall be taken to provide uniform coverage. Equipment that performs unsatisfactory shall be removed from the job.

329.5 PROTECTION FOR ADJACENT PROPERTY:

According to Section 333.

329.6 MEASUREMENT:

Bituminous emulsion that is diluted prior to application will be measured by the ton of diluted material. Any conversion from volumetric quantities shall be in accordance with Section 713.

329.7 PAYMENT:

Payment for the emulsified bituminous tack coat will be by the ton, diluted.

- End of Section -

ASPHALT CHIP SEAL

330.1 DESCRIPTION:

This work shall consist of the application of a bituminous material followed by the application of a cover material.

330.2 MATERIALS:

330.2.1 Asphalt: The type of grade of the bituminous material will be specified in the contract documents.

Paving grade asphalt shall meet the requirements to Section 711.

Liquid Grade asphalt shall meet the requirements of Section 712.

Emulsified asphalt shall meet the requirements of Section 713.

330.2.2 Aggregate: The cover material (chips) shall meet the requirements of Section 716. Gradation of the chips shall be as specified in Table 716-1 or Table 716-2.

330.3 TIME OF APPLICATION AND WEATHER CONDITIONS:

Chip seal shall not be applied for at least 7 days after completion of new bituminous paving.

The chip seal shall be placed only when the roadway surface is dry and there is no imminent threat of rain. The ambient temperature must be at least 60°F. and rising.

Caution should be exercised in the placement of asphalt chip seal between the dates of Oct. 1 and April 1.

330.4 CONSTRUCTION METHODS:

330.4.1 Preparation of surfaces: Immediately before applying the bituminous material, the area to be surfaced shall be cleaned of dirt and other objectionable material. In urban areas, the surface shall be cleaned with a self-propelled pickup sweeper. In rural areas, power brooms may be used. When necessary, cleaning shall be supplemented by hand brooms.

The bituminous material shall not be applied until an inspection of the surface has been made by the Engineer and he has determined that it is suitable.

For chip seals using paving grade asphalt as the binder, a bituminous tack coat shall be applied prior to sealing. The tack coat shall comply with Section 329. The exact rate shall be determined by the Engineer.

330.4.2 Application of Bituminous Material: The bituminous material shall be applied as soon as possible after preparation of surfaces. At the time of application, temperatures of the asphalt shall be within the ranges specified in Table 330-1 and Table 330-2 or in Sections 711, 712 and 713 for each specified asphalt type. The Engineer may require a specific temperature within the ranges.

The quantity of liquid or emulsified asphalts will be between the range of 0.20 and 0.40 gals. /sq. yd. The quantity of paving grade asphalt will be between the range of 0.17 and 0.31 gals. /sq. yd. The exact rate of application will be determined by the Engineer.

The bituminous material shall be placed using a distributor as specified in Section 330. Application methods shall insure that a uniform distribution is obtained over the area to be sealed.

The chips shall be spread before the bituminous material sets. The maximum distance that the bituminous material is applied in advance of the chips will be determined by the Engineer.

TABLE 330-1		
APPLICATION TEMPERATURES OF LIQUID ASPHALTS		
All types of Liquid Asphalt	Distributor Application Temperature, Degree F.	
	Min.	Max.
70	105	175
250	140	225
800	175	255
3000	215	290

TABLE 330-2		
APPLICATION TEMPERATURE OF EMULSIFIED ASPHALTS		
Grade of Emulsified Asphalts	Distributor Application Temperature, Degree F.	
	Min.	Max.
RS-1, CRS-1, CRS-1h	75	140
RS-2, CRS-2, CRS-2h	125	185
SS-1, CSS-1	75	130
SS-1h, CSS-1h	75	130

The surfaces of structures, trees and shrubbery adjacent to the areas being seal coated shall be protected in such manner as to prevent their being spattered with bituminous material or marred. The Contractor shall be responsible for all damage to such structures or landscaping.

330.4.3 Application of Cover Material: Immediately following the application of the bituminous material, the chips shall be spread with a self-propelled mechanical spreader. The chip spreading equipment shall be capable of applying a uniform application of cover material. The self-propelled requirement may be waived for projects under 10,000 sq. yds.

At the time of application, precoated aggregate shall be within the temperature range of 250 degrees F. and 350 degrees F. measured at a point 6 to 12 inches below the top of the load.

At the time of application, uncoated chips shall not contain moisture in excess of a saturated, surface dry condition when liquid or paving grade asphalt are used as the seal coat binder.

At the time of application, chips shall be surface wet but free from running water when emulsified asphalt is used as the seal coat binder.

The precise application rate for cover material will be determined by the Engineer within the ranges of 15 to 25 pounds per square yard for the 1/4 in. size and 20 to 30 pounds per square yard for the 3/8 in. size.

When so directed by the Engineer and within 48 hours after application of the precoated chips, all chipped surfaces on major streets shall receive a flush coat in accordance to Section 333. The exact rate of application shall be as directed by the Engineer.

330.4.4 Rolling: Immediately following the application of the cover material, the surface shall be rolled with self-propelled pneumatic-tired rollers. Three coverages shall be made with a pneumatic roller. Each roller shall carry a minimum of 2,000 pounds on each wheel and a minimum of 60 psi in each tire. The roller shall not travel in excess of 12 miles per hour. A minimum of 3 self-propelled pneumatic rollers shall be required for projects over 10,000 sq. yds. On projects under 10,000 sq. yds. one roller may be used provided it performs the same number of coverages.

330.4.5 Joints: All joints shall be constructed as approved by the Engineer such that there will be a uniform application of cover material and bituminous material.

330.4.6 Surplus Aggregate Removal: Surplus aggregate shall be removed from the surface using methods specified in Subsection 330.4.1 and stockpiled in the location indicated on the plans or as directed by the Engineer. In no event shall surplus aggregate be left on the pavement for more than one day (24 hours).

330.4.7 Distributing Equipment: Distributor trucks shall be of the pressure type with insulated tanks. Gravity distributors will not be permitted.

Spray bars and extensions shall be of the full circulating type. The spray bar shall be adjustable to permit varying height above the surface to be treated.

The nozzle spacings, center to center, shall not exceed 6 inches. The valves shall be operated so that one or all valves may be quickly opened or closed in one operation. The valves which control the flow from the nozzles shall be of a positive acting design so as to provide a uniform, unbroken spread of bituminous material on the surface.

The distributor shall be equipped with devices and charts to provide for accurate, rapid determination and control of the amount of bituminous material being applied. The distributor shall be equipped with a tachometer of the auxiliary wheel type registering speed in feet per minute. The distributor shall also be equipped with pressure gauges and an accurate thermometer for determination of the temperature of bituminous material. The spreading equipment shall be designed so that uniform application of a bituminous material can be applied in controlled amounts ranging from 0.05 to 2.0 gallons per square yard. Transverse variation rate shall not exceed ten (10) percent of the specified application rate. The distributor shall be equipped with a hose and nozzle attachment to be used for spotting skipped areas and areas inaccessible to the distributor. Distributor and booster tanks shall be maintained as to prevent dripping of bituminous material from any part of the equipment.

Equipment that fails to perform satisfactorily shall be removed from the job.

330.5 TRAFFIC:

Traffic will not be permitted on the surface until the cover aggregate has set. Traffic control shall be in accordance with Section 401 as supplemented by the Contracting Agency.

When using paving grade or liquid grade asphalt chip seal, the speed limit must be maintained at 25 mph for all equipment and traffic until the cover material is swept.

When using emulsified asphalt chip seals, only emergency or local access traffic will be allowed until the seal coat has had time to set.

330.6 MEASUREMENT:

Certified weight slips of all material shall be delivered to the Engineer before the materials are applied. Certified weight slips of any material being weighed back in for credit shall be delivered to the Engineer the next day.

330.7 PAYMENT:

Quantities of materials for this work will be paid for at the contract unit price.

(A) Asphalt Cement, Liquid Asphalt, Emulsion, Diluted Emulsion Ton

(B) Chips Ton

There will be no payment for materials not placed in accordance with this specification.

- End of Section -

PLACEMENT AND CONSTRUCTION OF ASPHALT EMULSION SLURRY SEAL COAT

332.1 DESCRIPTION:

The work covered by this specification consists of furnishing all labor, equipment, and materials necessary to perform all operations required for the application of an asphalt emulsion slurry surface.

NOTE: THESE SPECIFICATIONS DO NOT COVER THE APPLICATION OF COAL TAR SLURRY SEALS.

332.2 MATERIALS:

The asphalt emulsion material, mineral aggregate and mineral filler shall be as specified in Section 715.

332.3 EQUIPMENT:

332.3.1 General: When requested by the Engineer, descriptive information on the slurry seal mixing and applications equipment to be used will be submitted for approval no less than 7 days before the work starts.

332.3.2 Self Contained Slurry Machine: The mixing machine will be a continuous flow type. It will be capable of accurately delivering a predetermined proportion of pre-wetted aggregate, mineral filler, water and asphalt emulsion to the mixing chamber and discharging the thoroughly blended mixture on a continuous basis. The mixing machine will be equipped with a mineral filler feeder. The feeder will have an accurate metering device or method to introduce a predetermined proportion into the mixer. The filler will be introduced into the mixing chamber at the same time and location as the aggregate.

The mixing machine will be equipped with a water pressure system and fog-type spray bar, adequate for complete water fogging of the surface to be sealed.

The mixing machine will be mounted on a truck or other vehicle capable of producing evenly controlled low rates of speed throughout the operation to ensure the slurry is spread evenly and all cracks are filled.

332.3.3 Slurry Spreading Equipment: Attached to the mixer machine shall be a mechanical type squeegee spreader equipped with flexible material in contact with the surface to prevent loss of slurry from the distributor. It shall be maintained to prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread. There shall be a steering device and a flexible strike-off. The spreader box shall have an adjustable width. The box shall be kept clean. Build-up of asphalt and aggregate on the box shall not be permitted. The use of burlap drags or other drags shall be approved by the Engineer.

332.3.4 Rollers: Rollers shall be approved by the Engineer.

332.3.5 Cleaning Equipment: Power brooms, pick-up brooms, air compressors, water flushing equipment, and hand brooms shall be suitable for cleaning the surface and cracks of the old surface.

332.3.6 Auxiliary Equipment: Hand squeegees, shovels, and other equipment shall be provided as necessary to perform the work.

332.4 PREPARATION OF THE SURFACE:

332.4.1 Immediately before applying the slurry, the area to be surfaced shall be cleaned of dirt, loose material, and other objectionable material. In urban areas, the surface shall be cleaned with a self-propelled pick-up sweeper. In rural areas, power brooms may be used. When necessary, cleaning shall be supplemented by hand brooms. Water flushing will not be permitted in areas where cracks are present in the pavement surface.

The slurry shall not be applied until an inspection of the surface has been made by the Engineer and he has determined that it is suitable.

Revised 2012

332.4.2 Tack Coat: When specified, a tack coat shall be applied in accordance with Section 329 using the same type and grade of asphalt emulsion as specified for the slurry seal.

332.4.3 Water Fogging: When required by local conditions, the surface, directly ahead of the slurry box, shall be pre-wetted by fogging. The fogging shall be accomplished in such a manner that the entire surface is damp with no apparent flowing water or puddles.

332.5 WEATHER LIMITATIONS:

The slurry seal shall not be applied unless the pavement temperature is at least 45°F. and rising. The mixture shall not be applied during unsuitable weather.

332.6 PROTECTION OF UNCURED SURFACE:

Adequate means shall be provided by the Contractor to protect the uncured product. Any damage done to the product shall be repaired at the Contractor's expense.

332.7 MIXING AND APPLICATION:

The mixing time shall not exceed four minutes. Excessive mixing will not be allowed. The resulting mixture shall have the desired consistency, when placed on the surface. If breaking, hardening, segregation, balling or lumping occurs during the mixing process, the batch will be discarded.

A sufficient amount of slurry shall be carried in all parts of the spreader at all times so that a complete coverage is obtained.

No streaks caused by oversized aggregate shall be left in the finished surface. Build-up on longitudinal and transverse joints will be kept to a minimum. Approved squeegees shall be used to spread slurry in areas nonaccessible to the slurry mixer.

332.8 ROLLING:

As soon as the asphalt slurry has been set sufficiently to prevent any material from being picked up, it shall be rolled until all ridges have been ironed out and a uniform surface is obtained.

332.9 MEASUREMENT:

Quantities and materials for this work will be paid for at the contract price per unit of measurement for each of the following pay items as indicated in the proposal.

(A) Bituminous tack coat if specified	Ton (Diluted)
(B) Emulsified asphalt for slurry	Ton (Undiluted)
(C) Aggregate for slurry	Ton (Surface Dry)

- End of Section -

CONCRETE CURB, GUTTER, SIDEWALK, CURB RAMPS, DRIVEWAY AND ALLEY ENTRANCE

340.1 DESCRIPTION:

The various types of concrete curb, gutter, sidewalk, curb ramps, driveways and alley entrances shall be constructed to the dimensions indicated on the plans and standard detail drawings.

340.2 MATERIALS:

Concrete shall conform to the requirements of Section 725. Concrete class shall be as noted on the standard details.

Expansion joint filler shall be ½-inch thick preformed bituminous material in compliance with Section 729, unless otherwise noted.

340.2.1 Detectable Warnings: Truncated dome dimensions and spacing for detectable warnings are defined by the Americans with Disabilities Act Accessibilities Guidelines (ADAAG) for optimal detect-ability and public safety. Detectable warnings shall consist of raised truncated domes aligned in a square grid pattern in conformity to the ADAAG. Truncated domes shall have the following nominal dimensions: base diameter of 1.0 inches (0.9 inches minimum) top diameter of 50 percent of the base diameter minimum to 65 percent of the base diameter maximum, and height of 0.2 inches. Dome center-to-center spacing of 2.35 inches, measured between the most adjacent domes on the square grid. Dome center-to-center spacing for radial installations shall be 1.6 inches minimum and 2.4 inches maximum with a base-to-base spacing of 0.65 inches minimum. Detectable warning edges shall be sized and installed so that dome spacing is maintained across adjoining edges. Each dome shall have a minimum static friction of coefficient of 0.8 as tested per ASTM C1028.

340.2.1.1 Color and Contrast: Detectable warnings shall contrast visually with adjoining surfaces, either light-on-dark or dark-on-light. Specific colors to be used shall be approved by the local jurisdictional agency prior to installation. Detectable warnings shall have integral color throughout.

340.2.1.2 Materials: Detectable warning materials shall be durable with a non-slip surface not subject to spalling, chipping, delamination, or separation. All detectable warnings shall be approved by the local jurisdictional agency prior to installation.

340.2.1.3 Attachment System: Detectable warnings shall be either placed in freshly poured concrete (wet-set) or recessed into pre-formed concrete. Detectable warnings using wet-set placement shall have an anchoring method that assures constant contact of the detectable warning bottom surface with the concrete as it cures, thus rendering the ramp a single monolithic structure. The thicker and heavier detectable warnings lowered into pre-formed recesses in the concrete substrate must demonstrate a firm fitting into metal reinforced frames without gaps along the edges that can channel water, sand, or debris. They must also be able to resist movement (i.e. sliding, rocking, or lifting) once in service. All attachment systems shall be approved by the local jurisdictional agency.

340.3 CONSTRUCTION METHODS:

Existing concrete shall have a clean vertical edge where it is to be joined by new construction. Sawcutting is required when the existing matching edge is not a straight vertical edge.

340.3.1 Subgrade Preparation: The subgrade shall be constructed and compacted true to grades and lines shown on the plans and as specified in Section 301. All soft or unsuitable material shall be removed to a depth of not less than 6 inches below subgrade elevation and replaced with material satisfactory to the Engineer. Removal and replacement of soft or unsuitable materials will be paid for as extra work.

Subgrade classified as marginally expansive or expansive as defined in Table 340-1 shall be treated as follows unless the construction documents require alternative measures for mitigation of expansive soils. The upper 6 inches of marginally expansive soils shall be compacted per Section 301.3 at a moisture content between 0% to 3% above optimum moisture per ASTM D698. Expansive soils shall be considered unsuitable and shall be treated or removed and replaced with material as directed by the Engineer. Alternate corrective measures contained in an existing geotechnical report or new site analysis can be submitted to the Engineer for approval. The submittal of alternative corrective measures must be a recommendation of an

Arizona registered engineer and have the professional seal affixed.

Table 340-1

Description	Percent Fines (– #200 sieve) (1)	Plasticity Index (2)	Additional Testing
Non-expansive	> 20%	≤ 15	None
Potentially expansive		> 15	Perform Swell Test (3)

Description	% Swell (3)
Non-expansive	< 1
Marginally expansive	1 – 3
Expansive	> 3

(1) Tested in accordance with ASTM C117

(2) Tested in accordance with AASHTO T-90 (wet prep per AASHTO T-146)

(3) Swell Test: Samples for swell tests shall be re-molded in accordance with ARIZ 249 (ADOT Materials Testing Manual) to 95% of maximum dry density at optimum moisture as determined by ASTM D698 and tested for one-dimensional expansion in accordance with the applicable portions of ASTM D4546 applying a surcharge of 144 psf.

Material removed for construction shall not be placed on the base and/or surfacing material already in place on the roadway nor shall the excavated material be placed in such a manner as to interfere with access to property or traffic flow in the street.

340.3.2 Formwork: Concrete curbs, gutters and sidewalks shall be constructed by the conventional use of forms, or may be constructed by means of an appropriate machine when approved by the Engineer.

If machines designed specifically for such work and approved by the Engineer are used, the results must be equal to or better than that produced by the use of forms. If the results are not satisfactory to the Engineer, the use of the machine shall be discontinued and the Contractor shall make necessary repairs at his own expense. All applicable requirements of construction by use of forms shall apply to the use of machines.

Forms conforming to the dimensions of the curb, gutter, sidewalk, curb ramps, driveway, and alley entrance shall be carefully set to line and grade, and securely staked in position. The forms and subgrade shall be watered immediately in advance of placing concrete.

Forms shall be thoroughly cleaned each time they are used, and shall be coated with a light oil, or other releasing agent of a type which will not discolor the concrete.

340.3.3 Concrete Placement: The concrete shall be thoroughly spaded away from the forms so that there will be no rock pockets next to the forms. The concrete may be compacted by mechanical vibrators approved by the Engineer. Tamping or vibrating shall continue until the mortar flushes to the surface, and the coarse aggregate is below the concrete surface. The surface shall then be struck off and worked to grade and cross section with a float.

If machine placement is used, the machine shall place, consolidate and finish the concrete in one complete pass, requiring a minimum of hand finishing producing a dense and homogeneous section. A form shall trail behind the machine for such a distance that no appreciable concrete slumping will occur. Final finishing shall be as specified in Section 340.3.7, Form Removal and Finishing.

340.3.4 Joints: Shall be constructed in a straight line, vertical plane and perpendicular to the longitudinal line of the sidewalk, curb and gutter, single curb, etc., except in cases of curved alignment, where they shall be constructed along the radial lines of the curve.

Curb and gutter joints shall match the location of concrete pavement joints when abutting concrete pavement.

The space between joints in curbs and gutters (space between contraction joints or between contraction and expansion joints) shall not exceed ten feet.

Sidewalk that abuts curb or gutter shall have joints that match the curb or gutter joints.

Revised 2015

The space between sidewalk joints shall not exceed 125% of the sidewalk width (for example: maximum joint spacing for 5 foot wide sidewalk is 6.25 feet).

340.3.4.1 Expansion Joints: Expansion joints shall be constructed to the full depth and width of the concrete. The expansion joint material shall extend fully through the concrete and one inch into the subgrade with the top of the expansion joint material one-quarter inch below the top surface. Expansion joint material shall be secured in place prior to placement of concrete.

Expansion joints shall be installed along all abutting structures to provide complete separation from the structure.

Sidewalk, curb, and gutter expansion joints shall be installed at all radius points, at both sides of each driveway, at both sides of each alley entrance. The maximum distance between expansion joints shall be 50 feet.

340.3.4.2 Contraction Joints: Unless otherwise specified, the large aggregate in contraction joints shall be separated to either side of the joint for a minimum depth equal to 25% of the concrete thickness; the finished depth shall be a minimum of 3/4 inch.

340.3.5 Edges: All exposed edges shall be shaped with a suitable tool to form edges having the shape as indicated on the referenced detail.

340.3.6 Detectable Warnings: Detectable warnings shall be installed perpendicular to the direction of pedestrian/wheelchair travel and have a minimum width of 24 inches measured perpendicular to the edge of the roadway or rail crossing. The base surface of detectable warnings shall be installed flush with the adjacent walkway surface; the truncated domes shall extend above the walkway surface. The boundary between detectable warnings and the adjacent walkway shall provide a flush uniform surface that will not cause ponding of water nor present a tripping hazard. Partial domes at the edge of the detectable warning shall be made flush to match the base surface of the detectable warning. Detectable warnings installed on curb ramps shall extend the full width of the ramp depression.

Detectable warnings installed on curb ramps shall modify the sidewalk concrete thickness at the detectable warning to provide a minimum concrete thickness of four-inches (4”). When detectable warnings are modules inset into the curb ramp, the bottom surface of the sidewalk shall be lowered a distance equal to or greater than the module thickness to maintain the minimum sidewalk thickness. The sidewalk bottom surface shall have a minimum transition taper length of 12” between the thickened and normal depth sections of sidewalk. The detectable warning surface shall be located so that the edge nearest the curb line is 6 inches minimum and 8 inches maximum back from the face of curb.

Detectable warning surfaces for pedestrian at-grade rail crossings not located within a street or highway shall be installed on each side of the rail crossing, located as shown on plans. Detectable warnings shall extend the full width of the pedestrian walkway.

340.3.7 Form Removal and Finishing: The front face form shall not be removed before the concrete has taken initial set and has sufficient strength to carry its own weight. Gutter forms and rear forms shall not be removed until concrete has hardened sufficiently to prevent damage to the edges. Any portion of concrete damaged while stripping forms shall be repaired or replaced at no additional cost to the Contracting Agency.

After the forms are removed, the joints shall be tooled and the surface finished with a float to remove all imperfections. As needed, retool joints after finishing to prevent groove bonding. In all cases, the resulting surface shall be smooth and of uniform color with all rough spots, projections, and form stakes removed. No plastering of the concrete will be allowed. The concrete work shall have a true surface; shall be free from sags, twists, or warps; have a uniform appearance; and be true to the lines, grades, and configurations indicated on the drawings.

Surfaces shall be light broom finished; flow lines shall be troweled for a smooth finish.

If the evaporation rate on the concrete surface exceeds the rate of bleeding of the concrete due to weather conditions, materials used, or for any other reason, and there is any likelihood of the fresh concrete checking or cracking before the curing operation, measures shall be taken to prevent the rapid evaporation of water from the surface during finishing operations. When allowed by the Engineer, the addition of water to the surface may be permitted as an indirect fog spray with approved spray equipment immediately after screeding and/or between finishing operations. A commercial evaporation reducer that forms a monomolecular film may also be sprayed onto the concrete surface in accordance with the manufacturer’s recommendations. At no time will free water/evaporation reducer be worked into the concrete surface. Approved measures shall continue until curing operations per Section 340.3.8, Curing, are started in the particular area affected.

The Contractor shall stamp the company name and year on each end of the sidewalk or curb ramp constructed. The letters shall not be less than 3/4 inch in height and the depth of the stamped impression shall be between 1/8-inch and 1/4-inch.

340.3.8 Curing: As soon after the completion of the finishing operation as the condition of the concrete will permit, all exposed surfaces shall either be sprayed with a pigmented curing compound or sealed with a material conforming to Section 726. Curing compound shall be applied under pressure through a spray nozzle in such manner and quantity as to entirely seal all exposed concrete surfaces with a uniform film. The membrane shall be applied in two applications for a total coverage of 150 square feet per gallon. Concrete surfaces shall be kept damp until the curing compound is applied. Should the curing compound seal be broken or damaged before the expiration of 10 days after the placing of the concrete, the break shall be immediately repaired by the application of additional curing compound over the damaged area.

The need for adequate curing is greatest during the first few hours after placement of the concrete.

340.3.9 Tolerances: The face, top, back, and flow line of the curb and gutter shall not deviate in excess of 1/4-inch over 10 feet, as tested with a 10-foot straightedge or curve template, longitudinally along the surface.

The surface of concrete sidewalk or curb ramp shall not deviate in excess of 1/8-inch over 5 feet as tested with a 5-foot straightedge except for the 1/4-inch recess of the preformed material in expansion joints.

All finished concrete elevations shall not deviate from the elevations shown on the plans, or indicated by typical sections or standard details referenced within the construction documents, by more than 1/2 inch.

When required by the Engineer, gutters shall be water tested. The Contractor shall establish flow in the length of gutter to be tested by supplying and distributing water from a hydrant, tank truck or other source. After the supply of water is shut off and water has stopped flowing, the gutter shall be inspected for evidence of ponding or improper shape. The work shall be deemed deficient if water is found ponded in the gutter to a depth greater than 1/2 inch or ponding extends onto the adjacent asphalt pavement.

Areas between elevations shown on the plans shall be straight graded or smoothly transitioned through a vertical curve in a manner approved by the Engineer or as otherwise indicated on the construction documents.

340.3.10 Deficiencies: Any section of the work deficient in depth or not conforming to the plans or specifications shall be removed and replaced by the Contractor at no additional cost to the Contracting Agency. Replacement or reconstruction shall be from joint to joint.

Concrete work that does not comply with tolerance requirements of Section 340.3.9, Tolerances, shall be removed and replaced. Remove and replace gutters that exceed the ponding tolerance. Grinding shall only be allowed if approved by the Engineer.

340.4 BACKFILLING:

Unless otherwise specified the Contractor shall backfill behind the curbs, sidewalk or curb ramps with soil native to the area to the lines and grades shown on the plans.

340.5 MEASUREMENT:

Concrete curbs and gutters of the various types shown on the plans and in the proposal will be measured along gutter flow line through inlets, catch basins, driveways, curb ramps, etc., by the lineal foot to the nearest foot for each type, complete in place. Measurement for curb terminations and transitions shall be included with the linear measurement of the various types of curb or curb and gutter as shown on the plans and in the proposal.

Curb and gutter type shall be based on the configuration of the final exposed surfaces. The increased curb and gutter depth required at valley gutter aprons or driveways shall not be measured as a separate pay item; any additional Contractor cost shall be included in the unit cost associated with the valley gutter, driveway or other associated item.

Concrete sidewalks, driveways, alley intersections, valley gutters and aprons will be measured to the nearest square foot complete in place.

Detectable warnings shall not be measured for payment. Detectable warnings are considered integral to the walking surface that they form a part of and the cost is included in the related pay item.

Curb ramp installations shall be measured as complete installed units and shall include the ramp curb and the walking surfaces between the ramp curb and back of curb and gutter or single curb. Single curb or curb and gutter located at the edge of roadway shall be measured and paid for separately. The surface area of curb ramps shall not be included in the measured quantity for sidewalk.

340.6 PAYMENT:

Payment will be made in accordance with the unit prices or lump sums as set forth in the proposal. Such payment shall include full compensation for furnishing all labor, material, tools and equipment and accomplishing all work in conformance with the contract documents.

Over-excavation of soft, expansive or unsuitable materials and installation granular materials will be paid as a separate pay item, not included with the above measured pay items.

- End of Section -

CONCRETE STRUCTURES

505.1 DESCRIPTION:

Concrete bridges, culverts, catch basins, manholes, retaining walls, abutments, piers, footings, foundations and similar structures shall be constructed in conformity with the plans and specifications. Concrete for use in work constructed under this specification and testing thereof shall conform to the requirements of Section 725. Reinforcing shall conform to the requirements of Section 727.

Safe and suitable ladders shall be provided to permit access to all portions of the work.

505.1.1 Minor Structures: Concrete structures such as cattle guards, catch basins, median barriers, headwalls, and other miscellaneous structures as defined by the Engineer are hereby defined as Minor Structures. Such Minor Structures, at the option of the Contractor, may be either constructed of cast-in-place concrete, or furnished as precast units. Precast units shall be fabricated in accordance with shop drawings submitted by the Contractor and approved by the Engineer, in accordance with the requirements of Section 105.2. All structures not defined as Minor Structures shall be classified as Major Structures.

505.2 SUBGRADE FOR CONCRETE STRUCTURES:

Each subgrade upon which concrete is placed shall be firm and free from water. Ground water shall be kept several inches below subgrade until the concrete has set. When the subgrade is in dry earth, it shall be moistened with water from a spray nozzle immediately before concrete is placed.

When the design details for the project provide for the construction of filter or drain material consisting of gravel or combination of gravel and sand, which material becomes subgrade for concrete, the placing of steel reinforcement and placement of concrete shall follow the placing of the filter or drain material as closely as practical. The filter or drain material shall be kept dewatered to the extent necessary to prevent any portion of concrete materials being carried away before the concrete has attained its final set. No payment will be made for the work required to keep such materials dewatered, other than such costs as may be included in the prices bid for various items of work or amount bid for dewatering when the schedule provides an item for same.

When concrete is to rest on rock, the rock shall be fully uncovered. The surface of the rock shall be removed to a depth sufficient to expose sound rock. Bedrock shall be roughly leveled off or cut to approximately horizontal and vertical steps. Seams in the rock shall be grouted as directed by the Engineer and the base for structures shall be slush grouted or otherwise treated as the Engineer may direct.

Precast Concrete Minor Structures shall be founded in accordance with the requirements of Section 206.4.5.

505.3 FORMS:

Forming plans for cast-in-place bridge decks and cast-in-place bridge superstructures shall be prepared in accordance with the requirements of Section 105.2.

Forms shall be of suitable material and of type, size, shape, quality, and strength to enable construction as designed. The forms shall be true to line and grade, mortar tight, and sufficiently rigid to resist any appreciable amount of springing out of shape during placing of the concrete. The responsibility for their adequacy shall rest with the Contractor. All dirt, chips, sawdust, nails, and other foreign matter shall be completely removed from forms before any concrete is deposited. The surfaces of forms shall be smooth and free from irregularities, dents, sags and holes that would appreciably deface the finished surface. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being reused, and the reuse of forms shall be subject to the approval of the Engineer. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly treated with an approved releasing agent that will leave no objectionable film on the surface of the forms that can be absorbed by the concrete. Care shall be exercised that no releasing agent is deposited on previously placed concrete.

Forms for all surfaces that will not be completely enclosed or hidden below the permanent surface of the ground shall be made of surfaced lumber, or material which will provide a surface at least equally satisfactory. Any lumber or material which becomes badly checked or warped prior to placing concrete may be rejected.

Forms for all exposed surfaces of bridges, viaducts, overcrossings and similar structures shall be constructed of plywood or an approved equal. Plywood for forms shall be exterior type, of the grade Concrete-Form Exterior, conforming to the specifications of the NBS, Commercial Standards latest edition. Plywood shall be furnished and placed in 48 inches widths and in uniform lengths of not less than 96 inches, except where the dimension of the member formed is less than the specified panel dimension. Plywood shall be placed with the grain of the outer plies in the direction of the span. Where plywood is attached directly to the studding or joints, the panels shall be not less than 5/8 inch thick, and the studdings or joints shall be spaced not more than 12 inches, center to center. Plywood less than 5/8 inch thick, otherwise conforming to the requirements specified, may be used with a continuous backing of 5/8 inch sheathing. All form panels shall be placed in a neat, symmetrical pattern with the horizontal joints level and continuous.

Wood forms for copings and curbs shall have a thickness of not less than 15/8 inches and a width of not less than the full depth of coping or curb.

Unless otherwise shown on the plans, all sharp edges shall be chamfered with 3/4 inch triangular fillets. Forms for curved surfaces shall be so constructed and placed that the finished surface will not deviate appreciably from the arc of the curve.

Forms shall be so constructed that portions, where finishing is required, may be removed without disturbing portion of forms to remain.

Forms for girders and slabs shall be cambered as may be required by the Engineer.

Forms shall, as far as practicable, be so constructed that the form marks will conform to the general lines of the structure.

Form clamps or bolts, approved by the Engineer, shall be used to fasten forms. The use of twisted wire loop ties to hold forms in position will not be permitted, nor shall wooden spreaders be used unless authorized by the Engineer. Clamps or bolts shall be of sufficient strength and number to prevent spreading of the forms. They shall be of such type that they can be entirely removed or cut back 1 inch below the finished surface of the concrete. Forms for outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales, all based on the rate of concrete placement.

The Contractor may at his own option, place such portions of the concrete for the structure directly against the side of the excavation or sheathing without the use of outside forms, provided that the following conditions are met.

(A) If concrete is placed directly against the sides of the excavation, the faces of the excavation must be firm and compact, and be able to stand without sloughing off and be at all points outside the concrete lines shown on the plans.

(B) If concrete is placed against sheathing, such sheathing shall be closely fitted and shall be outside of the concrete lines shown on the plans. Those surfaces against which the concrete is to be placed shall be faced with building paper. Except as otherwise specified all sheathing shall be removed, but not until either at least 7 days after placing concrete or until the concrete has attained a strength in compression of not less than 2,000 psi. Care should be used in pulling sheathing so as to avoid damaging the concrete. Voids left by the removal of sheathing, piles and/or similar sheathing supports shall be backfilled with material having a sand equivalent of not less than 30 and consolidated by jetting as directed by the Engineer. When, in the opinion of the Engineer, field conditions or the type of sheathing or methods of construction used by the Contractor are such as to make the removal of sheathing impracticable, that portion of the sheathing against which concrete has been placed may be left in place.

Regardless of the method used in the placement of concrete without outside forms the following stipulations shall hold:

(A) The reinforcing steel shall be accurately set and held firmly in place, to the satisfaction of the Engineer.

(B) No direct payment will be made for building paper, sheeting, gunite or concrete placed outside of concrete lines shown on the plans. The cost thereof shall be absorbed in the prices bid for the various items of work.

(C) The Contractor shall assume all risks of damage to the work or to existing improvements due to any reason whatsoever that may be attributable to the method of construction outlined above.

505.3.1 Removal of Forms: The falsework supporting any span of a continuous or rigid frame structure subject to bending stress shall not be released until after the last concrete placed in the span and in the adjoining spans, excluding concrete above the deck slab, has attained a compressive strength of not less than twice the design unit stress, or 21 days after the concrete is placed, whichever occurs first.

Stairway riser forms shall be removed and the finish of the steps completed on the day the concrete is placed. Metal stairway treads, if required by the plans, shall be installed immediately after the steps have been placed.

Side forms for beams, girders, columns, railings, or other members wherein the forms do not resist dead load bending shall be removed not more than 24 hours after placing concrete, where finishing is required, unless otherwise directed by the Engineer, provided that satisfactory arrangements are made to cure and protect the concrete thus exposed.

Side forms for arch rings, columns, and piers shall be removed before the members of the structure which they support are placed so that the quality of the concrete may be inspected. Such forms shall be so constructed that they may be removed without disturbing other forms which resist direct load or bending stress.

Forms and shoring for box and arch sections of sewers and storm drains may be removed as follows:

(A) Forms for open channel walls — 16 hours.
(B) Outside forms of box sections and inside wall forms of box sections which do not support the slab forms — 16 hours.
(C) Arch sections in open cut — 12 hours.
(D) Slab forms for box sections:
    (1) Type II Cement — 48 hours or 6 hours per foot of span between supports, whichever is greater.
    (2) Type III Cement — 24 hours or 3 hours per foot of span between supports, whichever is greater.
    (3) Type V Cement — 56 hours or 7 hours per foot of span between supports, whichever is greater.

The periods of time at which the Contractor may remove forms, as set forth above, are permissive only and subject to the Contractor's assuming all risks that may be involved in such removals. At his option, except for surfaces to be finished, the Contractor may leave the forms in place for such longer periods as are, in his opinion, required.

505.4 FALSEWORK:

Falsework construction and erection shall not commence until the Contractor has received written approval of the sealed final falsework shop drawings.

All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure concrete were placed at one time.

All falsework, staging, walkways, forms, ladders, cofferdams, and similar accessories shall equal or exceed the minimum applicable safety requirements of Section 107. Compliance with such requirements shall not relieve the Contractor from full responsibility for the adequacy and safety of said items.

Falsework shall be founded upon a solid footing safe against undermining and protected from softening. When the falsework is supported on timber piles, the piles shall be driven to a bearing value as determined by the Contractor’s Engineer.

Falsework and forms shall be so constructed as to produce in the finished structure the lines and grades indicated on the plans. Suitable jacks or wedges shall be used in connection with the falsework to set the forms to grade or camber shown on the plans, or to take up any settlement in the form work either before or during the placement of concrete. Single wedges for this purpose will not be permitted; it being required that all such wedges be in pairs to insure uniform bearing. Dead load deflection in stringers and joints will be compensated for by varying depths of the joists or by using varying depth nailing strips.

Arch centering shall be removed uniformly and gradually, beginning at the crown and working toward the springing, to permit the arch to take its load slowly and evenly. Centering for adjacent arch spans shall be struck simultaneously.

Falsework under any continuous unit or rigid frame shall be struck simultaneously; the supporting supports being released gradually and uniformly, starting at the center and working both ways towards the supports.

505.4.1 Falsework Design: Falsework design shall be in accordance with the requirements of Section 105.2.

Falsework shall be designed by the Contractor to carry all loads and pressures which may be applied to it. The construction loads to be applied are as follows:

Tunnel centering – 100 percent of the concrete load where concrete is placed by pumping. Forms shall be so constructed to provide adequate relief for excessive pump pressure.

All other structures – a live load of 30 pounds per square foot of horizontal area.

Transverse and longitudinal bracing – a horizontal force equal to 2 percent of the vertical load.

The unit stresses for wood falsework shall be those recommended in the West Coast Lumbermen's Association's standard grading and dressing rules increased 25 percent for short time loading.

Falsework may be bolted or spiked at the option of the Contractor, but the use of bolts and spikes shall not be combined in the same connection. The allowable spacings and connection values of bolts and spikes shall be in accordance with the national design specifications for stress-grade lumber and its fastenings as recommended by National Lumber Manufacturers Association except that an additional allowance of 25 percent for temporary use shall be added to the connection values for bolts and spikes.

Ends of columns bearing on wedges shall be tied in both direction by girts.

Unit stresses for steel falsework shall be in accordance with the requirements of the specifications for design, fabrication and erection of structural steel for buildings of the AISC.

505.5 PLACING REINFORCEMENT:

Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position by wiring at intersections with wire not smaller than No. 16 gage and by using concrete or metal chairs, spacers, metal hangers, supporting wires and other approved devices of sufficient strength to resist crushing under full load. Wooden supports shall not be used.

Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted. Before placing in the forms, all reinforcing steel shall be thoroughly cleaned of mortar, oil, dirt, loose mill scale, loose or thick rust and coatings of any character that would destroy or reduce the bond. No concrete shall be deposited until the placing of the reinforcing steel has been inspected and approved.

Bundle bars shall be tied together at not more than 6 foot centers.

The Contractor will be allowed the following tolerances when placing, tying and supporting reinforcing steel:

(1) In slabs and beams, horizontal bars shall be within ¼ inch measured vertically, of the position indicated on the plans.
(2) In vertical walls, columns, wings, and similar members, clearance from the forms shall be within ¼ inch of the clearance shown on the plans.
(3) In slabs or walls, long runs of bars may vary up to 2 inches in spacing; however, the specified number of bars shall be placed.

505.5.1 Splicing: Splices of bars shall be made only where shown on the plans or as approved by the Engineer. Where bars are spliced they shall be lapped at least 30 diameters, unless otherwise shown on the plans.

Welding of reinforcing steel will not be permitted unless specifically authorized by the Engineer.

505.5.2 Bending Reinforcement: Bending of reinforcing steel shall conform to the requirements of the AASHTO LRFD Bridge Construction Specifications Section 9.4.

Bars shall not be bent nor straightened in a manner that will injure the material. Bars with kinks or unspecified bends shall not be used.

505.5.3 Welded Wire Fabric: Welded wire fabric shall be held firmly in place and spliced not less than 2 meshes.

505.5.4 Dowels:

505.5.4.1 Dowel Placement: Dowel placement shall consist of drilling or coring dowel holes in concrete, furnishing and placing anchoring materials, and placing reinforcing steel dowels in accordance with the details shown on the Project Plans, and the requirements of the project Special provisions and these Specifications.

Dowel holes shall be cored where dowels are to be placed:

(A) in bridge decks and other thin concrete sections, and the depth of the dowel hole shown on the project plans projects to 3 inches or less from the opposite face of the concrete section, or

(B) within 4 inches from an existing concrete edge.

Cored holes shall be intentionally roughened after coring.

All holes shall be blown clean with compressed air, prior to applying the anchoring material.

The diameter of the holes for the dowels shall be 1/8“ larger than the diameter of the dowels to be placed. The depth of the holes for the dowels shall be as shown on the Project Plans.

The anchoring materials for the dowels shall be an epoxy adhesive conforming to the requirements of Section 505.5.4.2, unless otherwise specified on the Project Plans and/or the project Special Provisions, or as approved by the Engineer.

505.5.4.2 Anchoring Materials: Epoxy materials shall be used for anchoring dowels. The Contractor shall, upon request, submit Certificates of Compliance or Analysis, complete with supporting documentation, to the Engineer for all epoxy materials to be used for anchoring dowels on a specific project, in accordance with the requirements of Section 106.2. The epoxy materials shall be provided by the Contractor in general conformance with the requirements of Section 1015-1 General Requirements of Section 1015 EPOXY MATERIALS of the current Arizona Department of Transportation (ADOT) Standard Specifications for Road and Bridge Construction, amended to date.

Epoxy resin base anchoring adhesive shall be used for anchoring dowels in concrete. High viscosity, or non-sag epoxies in the form of a gel, shall be used for horizontal or near-horizontal applications, where flow out of the anchoring hole is a problem. Low and medium viscosity epoxies may be used in vertical anchoring holes that open upward. The anchoring product shall specifically be designed for the designated application, according to the manufacturer’s product literature.

Epoxy resin base anchoring adhesive shall provide the specified minimum tensile pullout resistance, when tested in accordance with Arizona Test Method 725, as modified in accordance with Section 505.5.4.3 of these specifications. The pot life of the anchoring material shall be determined in accordance with AASHTO T-237, Part I. The determined pot life shall be within 25 percent or 10 minutes of the pot life specified by the manufacturer, whichever is greater.

505.5.4.3 Dowel Strength Requirements: The epoxy resin base anchoring adhesive shall provide the following minimum pullout resistances:

#4 dowels:	12.0 Kips
#5 dowels:	18.6 Kips
#6 dowels:	26.4 Kips
#7 dowels:	36.0 Kips

Arizona Test Method (ATM) 725 is a Tensile Proof Dowel Test, developed by ADOT to specifically test #6 reinforcing steel dowels anchored in Portland cement concrete with an epoxy adhesive. When testing reinforcing steel dowel sizes, the anchoring hole (ATM 725: PREPARATION – 4. (a)) shall be modified as follows; the rotary hammer drill bit size (ATM 725: APPARATUS – 2. (a)) shall be modified accordingly:

Revised 2017

#4 dowels:	5/8” diameter x 8” long
#5 dowels:	3/4” diameter x 10” long
#6 dowels	7/8” diameter x 12” long
#7 dowels	1” diameter x 14” long

The Contractor may opt to conduct pullout tests with hole lengths other than those required above, based on the adhesive manufacturer’s product literature and recommendations; however, test results shall demonstrate that the tested system provides the required pullout resistances.

505.6 PLACING CONCRETE:

No concrete shall be placed in any forms supported by falsework until the Contractor’s Professional Engineer has inspected the completed falsework, and has issued a properly sealed and signed certificate that the falsework has been constructed according to the approved falsework drawings.

Where a schedule for placing concrete is shown on the plans, no deviation will be permitted therefrom unless approved in writing by the Engineer.

The placing of concrete for a given pour shall start at the low point and shall proceed upgrade, unless otherwise permitted by the Engineer.

With the exception of concrete placed in slope paving and aprons, and concrete placed under water, all concrete shall be compacted by means of high frequency internal vibrators of a type, size and number approved by the Engineer. The number of vibrators employed shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases, at least 2 vibrators shall be available at the site of the structure in which more than 25 cubic yards of concrete is to be placed. The vibrators shall not be attached to or held against the forms or the reinforcing steel. The locations, manner and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without causing segregation of the mortar and coarse aggregate, and without causing water or cement paste to flush to the surface. Fresh concrete shall be spread in horizontal layers insofar as practicable and the thickness of the layers shall not be greater than can be satisfactorily consolidated with the vibrators. If additional concrete is to be placed, care shall be taken to remove all laitance and to roughen the surfaces of the concrete to insure that fresh concrete is deposited upon sound concrete surfaces. Layers of concrete shall not be tapered off in wedge-shaped slopes, but shall be built with square ends and level tops.

Mixed concrete, after being deposited, shall be consolidated until all voids are filled and free mortar appears on the surface. The concrete shall be placed as nearly as possible in its final position and the use of vibrators for extensive shifting of the mass of fresh concrete will not be permitted.

Fresh concrete shall not be permitted to fall from a height greater than 6 feet without the use of adjustable length pipes or elephant trunks.

The use of approved external vibrators for compacting concrete will be permitted when the concrete is inaccessible for adequate compaction provided the forms are constructed sufficiently rigid to resist displacement or damage from external vibration.

During the placing of concrete, care shall be taken that methods of compaction used will result in a surface of even texture free from voids, water or air pockets, and that the coarse aggregate is forced away from the forms in order to leave a mortar surface. Spades or broad-tined forks shall be provided and used to produce the desired results if required by the Engineer.

The use of chutes in conveying or depositing concrete will be allowed only at the discretion of the Engineer, and wherever they are used they shall be laid at such inclination as will permit the flow of concrete of such consistency as is required. The use of additional water in mixing the concrete to promote free flow in chutes of low inclination will not be allowed. Where necessary in order to prevent segregation, chutes shall be provided with baffle boards or a reversed Section at the outlet.

Concrete for columns shall be placed using pipes of adjustable length and not less than 6 inches in diameter.

Horizontal members or sections shall not be placed until the concrete in the supporting vertical members or sections has been consolidated and a minimum 2 hour period has elapsed to permit shrinkage to occur.

Walkways shall be provided along each side and for the full length of bridge structures outside the deck area. These walkways shall be of sufficient width, and so constructed as to provide for the support of the bridges from which the longitudinal floats specified are to be operated. Inspection walkways and access thereto shall be provided under the deck forms between each pair of girders and outside of each outside girder for the full length of the bridge structure. The walkways shall be not more than 8 feet below the concrete to be inspected.

505.6.1 Construction Joints in Major Structures: The work shall be so prosecuted that construction joints will occur at designated places shown on plans unless specifically permitted otherwise by the Engineer. The Contractor shall complete, by continuous depositing of concrete, section for the work comprised between such joints. The joints shall be kept moist until adjacent concrete is placed.

All construction joints at the bottom of walls or arches, at the top of walls, and all longitudinal construction joints having a keyed, stepped or roughened surface shall be cleaned by sandblasting prior to placing the adjacent concrete. Any quality of sand may be used which will accomplish the desired results.

The sandblasting operations shall be continued until all unsatisfactory concrete, and all laitance, coatings, stains, debris, and other foreign materials are removed. The surface of the concrete shall be washed thoroughly to remove all loose material. The method used in disposing of waste water employed in washing the concrete surfaces shall be such that the waste water will not stain, discolor, or affect exposed surfaces of the structures. The method of disposal will be subject to the approval of the Engineer.

All horizontal construction joints or those on slight slopes, shall be covered with Class D mortar as specified in Section 776.

Expansion and contraction joints in the concrete structures shall be formed where shown on the plans and as directed. In general, such joints shall have smooth abutting surfaces, painted or separated and sealed as detailed on the plans. No reinforcement shall be extended through the joints, except where specifically noted or detailed on the plans. Concrete or mortar shall not be permitted to lap these joints in such a manner as to effect a tie or bond that would later promote spalling.

Asphalt paint or premolded asphalt filler used in joints shall be as specified in Section 729.

No direct payment will be made for furnishing and placing asphaltic paint, premolded asphaltic filler or other types of joint separators; their costs shall be included in the price bid for the item of work of which they are a part.

505.6.2 Adverse Weather Concreting:

(A) Hot Weather Concreting: Hot weather is defined as any combination of high ambient temperature, low relative humidity, and wind velocity which would tend to impair the quality of fresh concrete. These effects become more pronounced as wind velocity increases. Since last minute improvisations are rarely successful, preplanning and coordination of all phases of the work are required to minimize these adverse effects.

As an absolute minimum, the Contractor shall insure that the following measures are taken:

(1) An ample supply of water, hoses, and fog nozzles are available at the site. (2) Spare vibrators are on hand in the ratio of one spare vibrator for each three in use. (3) Preplanning has been accomplished to insure prompt placement, consolidation, finishing, and curing of the concrete. (4) Concrete temperature on arrival should be approximately 60°F. and in any event shall not exceed 90°F. The use of cold water and ice is recommended. (5) The subgrade is moist, but free of standing water. (6) Fog spray is utilized to cool the forms and steel. Under extreme conditions of high ambient temperature, exposure to the direct rays of the sun, low relative humidity, and wind, even strict adherence to these measures may not produce the quality desired and it may be necessary to restrict concrete placement to early morning only. If this decision is made, then particular attention must be directed to the curing process since the concrete will be exposed to severe thermal stresses due to temperature variation; heat of hydration plus midday sun radiation versus nighttime cooling.

(B) Cold Weather Concreting: Concrete shall not be placed on frozen ground, nor shall it be placed when the ambient temperature is below 40°F. unless adequate means are used to heat the aggregate and/or water and satisfactory means have been taken for protecting and heating the concrete during the curing period.

(C) Wet Weather Concreting: Placing of concrete shall be discontinued when the quantity of rainfall is such as to cause a flow or wash to the surface. Any concrete already placed and partially cured shall be covered to prevent dimpling. A construction joint will be installed prior to shut down.

(D) Replacement of Damaged or Defective Concrete: Upon written notice from the Engineer, all concrete which has been damaged or is defective, shall be replaced by the Contractor at no cost to the Contracting Agency.

(E) Recommended Reference:
(1) ACI-305 Hot Weather Concreting
(2) ACI-306 Cold Weather Concreting
(3) ACI-308 Recommended Practices for Curing Concrete

505.6.3 Bridge Deck Joint Assemblies:

505.6.3.1 Description: This work shall consist of furnishing and installing expansion devices including the seals, anchorage system, and hardware in accordance with the project plans and these specifications.

505.6.3.2 Materials: Elastomer Seals shall be of the Compression Seal or Strip Seal type, and shall conform to the requirements of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction Section 1011-5.

Steel shapes and plates shall conform to the requirements of ASTM A36, or ASTM A588.

505.6.3.3 Construction Requirements:

(1) General: Deck joint assemblies shall consist of elastomer and steel assemblies which are anchored to the concrete at the deck joint. The seal armor shall be cast in the concrete. The completed assembly shall be properly installed in the planned position, shall satisfactorily resist the intrusion of foreign material and water, and shall provide bump-free passage of traffic. For each size of seal on a project, one piece of the seal material supplied shall be at least 18 inches longer than required by the project Plans. The additional length will be removed in the presence of the Engineer and used for materials testing. Upon request, Certificates of Compliance conforming to the requirements of Section 106.2 shall also be submitted by the Contractor.

(2) Shop Drawings**:** Prior to fabrication, the Contractor shall submit shop drawings to the Engineer for approval, in accordance with the requirements of Section 105.2. The shop drawings shall show complete details of the method of installation to be followed, including a temperature correction chart for adjusting the dimensions of the joint according to the ambient temperature, and any additions or rearrangements of the reinforcing steel from that shown on the project plans.

(3) Elastomer Seals: Seals shall conform to the requirements specified.

(4) Armor: All steel for cast-in-place deck joint assemblies shall conform to the requirements specified.

(5) Galvanizing**:** All steel parts of strip seal assemblies shall be galvanized after fabrication, in accordance with the requirements of ASTM A123 and A153, unless ASTM A588 steel is used. Bolts shall be high strength, conforming to the requirements of ASTM A325M, with a protective coating of zinc, followed by a chromate and baked organic coating conforming to the requirements of ASTM F1135, Grade 3, 5, 6, 7, or 8 and Color Code A.

Steel parts of compression seal assemblies do not require galvanizing, plating, or painting.

(6) Joint Preparation and Installation: At all joint locations, the Contractor shall cast the bridge decks and abutment backwalls with a formed blockout, sized to accommodate the pre-assembled joint assembly. The joint assembly will be anchored in the concrete to be placed with the secondary pour in the blockout. Prior to the secondary pour, the surface of the existing concrete in the blockout shall be coated with an approved adhesive specifically formulated for bonding new concrete to old concrete.

(7) Welding: All welding and inspection of welding for structural steel shall be performed in accordance with the requirements of the latest revision of the AASHTO/AWS D1.5M/D1.5 Bridge Welding Code. The use of electro-slag welding process on structural steel will not be permitted.

Installed armor assemblies shall be covered or otherwise protected at all times prior to installing the elastomer portion of the joint assembly. The elastomer shall be installed at such time and in such manner that it will not be damaged by construction operations.

Immediately prior to the installation of the seal element, the steel contact surfaces of the joint armor shall be clean, dry, and free of oil, rust, paint, or foreign material. Any perforation or tearing of the seal element due to installation procedures or construction activities will be cause for rejection of the installed seal element.

During the installation of all proprietary deck joint assemblies, the manufacturer's representative shall be present. As a minimum, the representative shall be present during the placement of the joint assembly in the deck blockout, prior to the secondary concrete pour, and shall also be present during the installation of the seal element.

505.6.4 Water Stops: Water stops of rubber or plastic, shall be placed in accordance with the details shown on the project plans. Where movement at the joint is provided for, the water stops shall be of the type permitting such movement without damage. Water stops shall be mechanically spliced, vulcanized, or heat-sealed to form continuous watertight joints, in accordance with the manufacturer's recommendations, and as approved by the Engineer.

505.6.5 Longitudinal Joints between Precast Bridge Deck Units: After erection of the units and at the time requested by the Engineer, the longitudinal shear key joints between units shall be thoroughly packed with a pre-packaged non-shrink grout or a sand-cement grout with an expansion agent approved by the Engineer. The Contractor shall then transversely connect the deck units with the connection rods, stressing and anchoring them as shown on the project plans.

505.7 CONCRETE DEPOSITED UNDER WATER:

When conditions render it impossible or inadvisable in the opinion of the Engineer to dewater excavation before placing concrete, the Contractor shall deposit under water, by means of a tremie or underwater bottom dump bucket, a layer of concrete of sufficient thickness to thoroughly seal the cofferdam. To prevent segregation the concrete shall be carefully placed in a compact mass and shall not be disturbed after being deposited. Water shall be maintained in a still condition at the point of deposit.

A tremie shall consist of a water tight tube having a diameter of not less than 10 inches with a hopper at the top. The tube shall be equipped with a device that will close the discharge end and prevent water from entering the tube while charging the tube with concrete. The tremie shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering, when necessary to retard or stop the flow of concrete. The discharge end shall be closed at the start of the work to prevent water entering the tube and shall be entirely sealed at all times, except when concrete is being placed. The tremie tube shall be kept full of concrete. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete. The flow shall be continuous until the work is completed and the resulting concrete seal shall be monolithic and homogeneous.

The underwater bucket shall have an open top and the bottom doors shall open freely and outward when tripped. The bucket shall be completely filled and slowly lowered to avoid back wash and shall not be dumped until it rests on the surface upon which the concrete is to be deposited. After discharge, the bucket shall be raised slowly until well above the concrete.

Concrete deposited in water shall have 10 percent extra cement added.

505.8 CURING:

As soon after the completion of the specified finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surface shall either be sprinkled with water, covered with earth, sand or burlap; sprayed with a curing compound or sealed with a material conforming with Section 726. All concrete for bridge structures shall be water cured unless otherwise permitted by the Engineer. The Contractor shall use the wet burlap method for the water cure of all concrete in bridge decks and approach slabs, unless otherwise authorized by the Engineer.

Concrete that is water cured must be kept continuously wet for at least 10 days after being placed; preferably being covered, if possible, with at least 2 layers of not lighter than 7 ounce burlap, except that handrail, baserail, railing posts, tops of walls, and similar parts of the structure, if water cured, must be covered with burlap as above prescribed, immediately following the

finishing treatment specified therefore, and such covering shall not be removed in less than 4 days. Roadway areas, floors, slabs, curbs, walks, and the like, that are water cured may be covered with sand to a depth of at least 2 inches, in lieu of the burlap as specified above, as soon as the condition of the concrete will properly permit, and such covering must remain wet and in place until the concrete so covered is at least 10 days old unless otherwise directed by the Engineer or provided by special provisions.

When a sprayed impervious membrane is used, it shall be applied under pressure through a spray nozzle in such manner and quantity as to entirely cover and seal all exposed surfaces of the concrete with a uniform film. To insure complete coverage, membrane shall be applied in two applications for a total coverage of 150 square feet per gallon. The membrane, however, shall not be applied to any surface until all of the finishing operations have been completed; such surfaces being kept damp, until the membrane is applied. All surfaces on which a bond is required, such as construction joints, shear planes, reinforcing steel, and the like, shall be adequately covered and protected before starting the application of the sealing medium in order to prevent any of the membrane from being deposited thereon; and any such surface with which the seal may have come in contact shall immediately thereafter be cleaned. Care shall be exercised to avoid and prevent any damage to the membrane seal during the curing period. Should the seal be broken or damaged before the expiration of 10 days after the placing of the concrete, the break shall be immediately repaired by the application of additional impervious membrane over the damaged area.

Should any forms be removed sooner than 10 days after the placing of the concrete, the surface so exposed shall either be immediately sprayed with a coating of the membrane seal, or kept continuously wet by the use of burlap or other suitable means until such concrete has cured for at least 10 days.

When tops of walls are cured by the membrane sealing method the side forms, except metal forms, must be kept continuously wet for the 10 days following the placing of the concrete.

If due to weather conditions, materials used, or for any other reason, there is any likelihood of the fresh concrete checking or cracking prior to the commencement of the curing operations, it shall be kept damp, but not wet, by means of an indirect fine spray of water until all danger of such checking or cracking is past, or until the curing operations are started in the particular area affected.

Since hot weather leads to more rapid drying of concrete, protection and curing are far more critical than in cool weather. Water curing shall be used wherever it is practical and shall be continuous to avoid volume changes due to alternation of wetting and drying. The need for adequate continuous curing is greatest during the first few hours after placement of concrete in hot weather.

505.9 FINISHING CONCRETE:

Immediately after the removal of forms as provided above, all concrete surfaces shall be finished in accordance with the requirements specified below.

All surfaces scheduled to be covered with backfill shall be finished so as to be free of open and rough spaces.

All surfaces that will remain exposed in the completed work shall be finished so as to be free of open and rough spaces, depressions or projections. All angles and fillets shall be sharp and true and the finished surface shall present a pleasing appearance of uniform color.

All top surfaces of walls, abutments, piers, etc., shall be finished to a smooth surface and shall be cured by an approved method.

If rock pockets or honeycomb are of such an extent and character as to affect materially the strength of the structure and to endanger the steel reinforcement the Engineer may declare the concrete defective and require the removal and replacement of that portion of the structure affected by the Contractor at no additional cost to the Contracting Agency.

If finishing operations are not carried out as set forth below, all placing of concrete shall stop until satisfactory arrangements are made by the Contractor to promptly correct defective finishing work and to carry out finishing operations as specified.

One of the classes of finish as specified shall be applied to the various surfaces as set forth under applicability of finishes.

No finishing or patching shall be permitted until the surface has been inspected by the Engineer.

505.9.1 Finishing Fresh Concrete in Bridge Decks: Upon placing the deck to a uniform and true surface, screed supports shall promptly be removed from the surface and any necessary hand finishing shall be promptly accomplished in the areas where the screed supports have been removed.

After final floating of the plastic concrete, bridge decks subject to vehicular traffic shall be textured transversely. Apparatus producing textured grooved shall be mechanically operated from an independent self-propelled bridge. Grooves shall be 1/16 to 1/8 inch in width and 3/32 to 6/32 in depth. Center to center spacing of the grooves shall be as follows: 7/8 inch, 3/4 inch, 1 inch, 3/4 inch, 1-1/8 inch and then repeated or other measurements as approved by the Engineer. Texturing shall be completed before surface of concrete is torn or unduly roughened by texturing operation. Grooves that close following texturing will not be permitted and will have to be retextured. Hand tine brooms shall be available on the job site, at all times during texturing operation, to repair faulty texturing grooves.

The finished surface will be tested with a 10 foot straightedge furnished by the Contractor. The testing will be accomplished by holding the straightedge in contact with the deck surface and parallel to the centerline. The surface shall not vary more than 1/8 inch from the lower edge of the straightedge. Areas showing high spots of more than 1/8 inch shall be corrected by cutting or planning. The cutting or planning machine shall be a rotary type, equipped with an adjustable cutter and having a minimum wheel base of 10 feet. Areas showing low spots of more than 1/8 inch shall be filled with an approved mixture of sand, cement and epoxy. The mixture shall firmly adhere to the surface and shall match the surrounding concrete. All areas corrected shall not show deviations in excess of 1/8 inch when tested with a 10 foot straightedge.

505.9.2 Finishing Fresh Concrete in Sidewalks and Bridge Sidewalks: After the concrete has been placed and spread between the forms, it shall be thoroughly worked until all the coarse aggregate is below the surface and the mortar comes to the top. Concrete may be consolidated by means of mechanical vibrators approved by the Engineer.

The surface shall then be struck off and worked to grade and cross-section with a wood float.

A mechanical finishing machine that will consolidate the concrete and strike off and finish the surface may be used if permitted by the Engineer, provided that the machine produces a sidewalk equal to or better in all respects than that produced by the methods specified herein.

The surface shall be sweat finished by means of a steel trowel followed by a light broom finish.

The sidewalks shall be marked and edged with the proper tools to form the joints, marking and edges shown on the plans.

505.9.3 Finishing Green Concrete: Class I Finish — All bolts, wires and rods shall be clipped and recessed. All holes, honeycomb, rock pockets and other surface imperfections shall be cleaned out, thoroughly moistened and carefully patched with mortar. Mortar shall be composed of 1 part of cement and 2 parts of fine sand. A portion of the required cement for mortar shall be white as required to match the color of the surrounding concrete.

Class II Finish — The surface shall be patched and pointed as specified above for Class I Finish and then promptly covered with polyethylene film, wet burlap or wet cotton mats. If polyethylene film is used, the film shall be held securely to the surface by means of weights, adhesive or other suitable means. Only white polyethylene film for covering will be acceptable.

When the mortar used in patching and pointing has set sufficiently, the surface shall be uncovered and thoroughly rubbed with either a float or a carborundum stone until the surface is covered with a lather. Cork, wood or rubber floats shall be used only on surfaces sufficiently green to work up such lather, otherwise a carborundum stone shall be used. During the rubbing process, a thin grout composed of 1 part cement and 1 part of fine sand may be used to facilitate producing a satisfactory lather; however, this grout shall not be used in quantities sufficient to cause a plaster coating to be left on the finished surface. A portion of the required cement for grout shall be white as required to match the color of the surrounding concrete. Rubbing shall continue until irregularities are removed and there is no excess material. At the time a light dust appears, the surface shall be brushed or sacked. Brushing or sacking shall be carried in one direction so as to produce a uniform texture.

Class III Finish — The surface shall be treated as specified above under Class II Finish except that after brushing, the surface shall again be securely covered with polyethylene film, wet burlap or wet cotton mats. In not less than 1 day nor more than 4 days, the surface shall be uncovered and rubbed with a carborundum stone. This rubbing shall continue until the entire surface

is of a smooth texture and uniform color. During the process, the use of a thin mixture of equal parts of sand and cement with water will be permitted. At the time a light dust appears, the surface shall be brushed or sacked, care being taken to carry this brushing in one direction so as to produce a uniform texture.

505.9.4 Finish Hardened Concrete: If for reasons either beyond the control of the Contractor or with the approval of the Engineer, more than 6 days have elapsed between the time of placing concrete and the time of the removal of forms, the concrete shall be considered as hardened. Prior to finishing hardened concrete, the surface shall be covered with burlap or cotton mats and kept thoroughly wet for a period of at least 1 hour. Finishing shall be identical to the respective requirements for Class I, Class II and Class III Finish for green concrete, except that the use of a mechanically operated carborundum stone will be required for Class II and Class III Finishes.

505.9.5 Applicability of Finishes: Surfaces requiring Class I Finish — All formed structures that are to be covered by backfill and those surfaces that are normally not in view of either vehicular or pedestrian traffic such as the surfaces on the inside of barrels of culverts, the under surfaces of decks, surfaces of concrete girders, piers and abutment walls.

Surfaces requiring Class II Finish — All exposed surfaces of headwalls, wingwalls, deck edges on culverts, end of piers on bridges and culverts, retaining walls and those vertical surfaces under highway grade separation structures that are exposed to view of the traveling public, including piers and pier caps, the outside face of outside girders, and other similar surfaces.

When surfaces of uniform texture and pleasing appearance are obtained through the use of first class metal forms, paper tubing or the use of special form coatings and the use of special care, such surfaces may, upon approval of the Engineer, be excluded from the surfaces requiring Class II Finish.

Surfaces requiring Class III Finish for bridge structures — All formed or finished surfaces above the surface of the deck on the roadway side of the handrail and the outside vertical surfaces from the top of handrail and dado to the lower edge of the chamfer at the bottom of the deck.

505.10 DIMENSIONAL TOLERANCES:

The maximum allowable tolerances or deviations from dimensions shown on the project plans or the approved shop drawings shall be as follows:

505.10.1 Cast-in-Place Concrete:

(A) Variation from plumb in the lines and surfaces of columns, piers, abutment and girder walls:
In any 10 foot or less length: 0.4 inches
Maximum for the entire length: 1 inch

(B) Variation in cross-sectional dimensions of columns, piers, girders, and in the thickness of slabs and walls:
+ 1/4 inch
- 1/8 inch

(C) Girders alignment (deviation from straight line parallel to center line of girder measured between diaphragms):
1/8 inch per every 10 feet in length

(D) Variation in footing cross-sectional dimensions in project plans:
+ 2 inches
- ½ inch

(E) Variation in footing thickness:
Greater than specified - No Limit
Less than specified - 5 percent of specified thickness up to a maximum of 1 inch

(F) Subgrade Tolerances:
Slab poured on subgrade excepting footing thickness:
+ 1/4 inch
- 3/4 inch

(G) Girder Bearing Seats:
Deviation from plane surface (flatness): ± 1/8 inch in 10 feet.
Deviation from required elevation:
+ 1/4 inch
- 1/8 inch

(H) Cast-in-Place concrete box girder superstructures:
Deviation in overall depth:
+ 1/4 inch
- 1/8 inch
Deviation in slab and wall thickness:
+ 1/4 inch
- 1/8 inch
Deviation of post-tensioning ducts:
± 1/4 inch

505.10.2 Minor Precast Concrete Structures: Precast units that do not comply with the dimensional tolerances specified herein will be rejected. Precast units that show evidence of cracks, pop outs, voids or other evidence of structural inadequacy, or imperfections that will reduce the aesthetics of the unit after final placement will be rejected. The maximum allowable tolerances or deviations from the dimensions shown on the drawings shall be as follows:

(A) Over-all dimensions of member: ± 1/4 inch per 10 feet, maximum of ± 3/4 inch.

(B) Cross-sectional dimensions: sections 6 inches or less ± 1/8 inch
Sections 18 inches or less and over 6 inches ± 1/4 inch
Sections 39 inches or less and over 18 inches ± 1/4 inch

(C) Deviations from straight line:
Not more than 1/4 inch per 10 feet
All exposed, sharp corners of the concrete shall be filleted ¾ inches with a maximum allowable deviation of ± 1/8 inch.

505.11 MEASUREMENT:

505.11.1 Reinforcing Steel: When reinforcing steel is scheduled for payment as a specific item, it will be measured in pounds, based on the total computed weight for the size and length of bars, or for the area of welded wire fabric, as shown on the Project Plans or as approved by the Engineer.

Unit bar weights for deformed and plain billet-steel bars will be the nominal unit weights specified in AASHTO M-31 (ASTM A615).

Area unit weights for steel welded wire fabric will be calculated based on specified wire spacing's and unit weights for specified wire types and sizes. Unit weights for plain wire shall be based on the nominal areas specified for Wire Size Numbers in AASHTO M-32 (ASTM A82). Unit weights for deformed wire shall be the nominal unit weights specified for Deformed Wire Size Numbers in AASHTO M-225 (ASTM A496).

If the area unit weights for steel welded wire fabric are specified on the Project Plans or in the Special Provisions, both the Contractor and the Engineer shall independently calculate the area unit weight, using specified wire spacing's, types and sizes, and the criteria in the preceding paragraph. Any apparent discrepancy between the specified and calculated area unit weights shall be resolved by the Engineer prior to the Contractor placing the order for the steel welded wire fabric.

Lap splices made for the convenience of the Contractor will not be included in the measurement for payment.

Reinforcing steel for Minor Structures, as defined in Section 505.1.1, will not be measured, but will be included in the items unit price or specified method of payment, unless otherwise called out on the Project Plans or in the Special Provisions.

Dowel Placement will be measured by the unit each.

505.11.2 Concrete: When concrete is scheduled for payment on the basis of cubic yards, the calculation of the quantity of concrete for payment will be made only to the neat lines of the structures as shown on the plans. The quantity will be based on the concrete having the specified plan lengths, widths/depths, and thicknesses. However, all concrete shall be placed to line and grade within the tolerances specified in Section 505.10, or as approved by the Engineer as being reasonable and acceptable for the type of work involved. No volumetric deductions will be made for rounded or beveled edges, space occupied by reinforcing steel, metal inserts, or openings 0.5 square yard or less in area.

The quantity of concrete will be calculated considering any mortar used to cover construction joints as being concrete. The cost of cement used in any mortar for covering construction joints, patching, or other uses in the structure being constructed, in excess of that required for the design mix of the adjacent concrete, shall be absorbed in the cost of the item of work of which said mortar is a part.

505.11.3 Deck Joint Assemblies: Deck joint assemblies will be measured to the nearest tenth of a foot. Measurement will be made along the centerline of the joint, at the surface of the roadway, from face-to-face of curb or barrier. No measurement will be made for that portion of the deck joint assembly required by plan details to extend through the barrier face or curb; that portion of the joint assembly will be considered incidental to the sealing of the joint.

505.11.4 Bridge Railing, Curbs, Barriers, and Approach Slabs:

Bridge Pedestrian Fence and Curb, Bridge Pedestrian Fence and Parapet, and Bridge Fence and Parapet will be measured to the nearest tenth of a foot, from end post to end post.

Bridge Traffic and Pedestrian Rail will be measured to the nearest foot, determined from the outside dimensions of the rail.

Bridge Concrete Barrier will be measured to the nearest tenth of a foot.

Barrier Concrete Barrier Transition will be measured as a unit for each constructed.

Reinforced Concrete Approach Slab will be measured to the nearest square yard.

505.12 PAYMENT:

Payment for Portland cement concrete structures will be made in conformity with the terms of the contract and will be based on unit prices and/or lump sums as set forth in the proposal. Such payment shall include full compensation for furnishing all labor, materials, tools and equipment, preparation of subgrade for placing of concrete and doing all work required to construct the structures in conformity with the plans and specifications.

505.12.1 Reinforcing Steel: The accepted quantities of reinforcing steel, of the type indicated on the Project Plans or specified in the Special Provisions, and measured in conformance with Section 505.11.1 will be paid for at the contract unit price per pound, complete in place.

The accepted quantity of dowels placed will be paid for at the contract unit price for Dowel Placement, which shall be full compensation for the work, complete in place. Steel reinforcement furnished for the dowels will be measured and paid for under the pay item Reinforcing Steel.

No measurement or direct payment will be made for dowels which are required to replace existing reinforcing steel that is damaged as a result of the Contractor's operations; the Contractor shall furnish and place such dowels at his own expense.

505.12.2 Concrete: Payment for Portland cement concrete structures will be made in conformity with the terms of the contract and will be based on unit prices and/or lump sums as set forth in the proposal. Such payment shall include full compensation for furnishing all labor, materials, tools and equipment, preparation of subgrade for placing of concrete, and doing all work required to construct the structures in conformity with the plans and specifications.

Where concrete is scheduled for payment on the basis of cubic yards, the calculation of the quantity of concrete for payment will be made only to the neat lines of the structures as shown on the plans and on the basis of the concrete having the specified lengths, breadths, and thicknesses. The quantity of such concrete will be calculated considering the mortar used to cover construction joints as being concrete and no deductions will be made for rounded or beveled edges, space occupied by

reinforcing steel, metal inserts, or openings 5 square feet or less in area. The cost of cement used in mortar for covering construction joints, patching, or other uses in the structure being constructed, in excess of that required for the design mix of the adjacent concrete, shall be absorbed in the item of work of which said mortar is a part.

An adjustment in the contract unit price, to the nearest cent, will be made for the quantity of concrete represented by the results of cylinder strength tests that are less than the specified 28-day compressive strength. Strength tests will be conducted in accordance with Section 725.8. The adjustment in contract unit price, if the concrete is accepted, will be based on Table 725-2 in Section 725.9.

The contract unit price for structural concrete shall include full compensation for all items incidental to providing a concrete structure complete in place, including waterstops, roadway drains, scuppers, metal inserts, and bearing pads.

505.12.3 Minor Concrete Structures and Accessories:

The accepted quantities of:

Minor Structures	Each
Deck Joint Assemblies	0.1 Foot
Bridge Pedestrian Fence and Curb	0.1 Foot
Bridge Pedestrian Fence and Parapet	0.1 Foot
Bridge Fence and Parapet	0.1 Foot
Bridge Traffic and Pedestrian Rail	Foot
Bridge Concrete Barrier	0.1 Foot
Bridge Concrete Barrier Transition	Each
Reinforced Concrete Approach Slab	Square Yard

will be paid for at the unit price and/or lump sums as set forth in the proposal. The contract unit price shall include full compensation for all labor, materials, tools and equipment necessary to provide the concrete structure or accessory complete in place, including all concrete, reinforcing steel, and items embedded in the concrete, such as anchor bolts, grates and frames, metal inserts, etc.

- End of Section -

Section 633. — PERMANENT TRAFFIC CONTROL

Description

633.01 This work consists of installing and removing and resetting permanent traffic control devices.

Sign panels are designated as plywood, steel, aluminum, plastic, fiberglass reinforced plastic, or extruded aluminum.

Sign posts are designated as wood, aluminum, galvanized steel, or corrosion resistant steel.

Material

633.02 Conform to the MUTCD and the following Section and Subsections:

Delineator and object marker retroreflectors	718.08
Hardware	718.06
Legends and borders	718.07
Minor concrete	601
Object marker and delineator posts	718.05
Panels	718.03
Retroreflective sheeting	718.01
Sign posts	718.04

Construction Requirements

633.03 General. Furnish and install permanent traffic control devices according to the MUTCD and permanent traffic control plans. Provide traffic control devices that are crashworthy.

Sign locations may be changed to fit field conditions as approved by the CO. Determine sign support lengths at time of staking.

633.04 Sign Posts. Install sign posts plumb and according to the manufacturer's recommendations.

Drive sign posts with a suitable driving head or set posts in drilled or punched holes.

Excavate, construct, and backfill concrete footings according to Section 601.

633.05 Sign Panels.

(a) Fabrication.

(1) Panels. Cut panels to dimension shown and place holes before applying retroreflective material. Do not field drill holes in panels.

Clean and degrease the face of the metal panels using methods recommended by the retroreflective sheeting manufacturer before applying retroreflective sheeting.

Wipe plastic panels clean with a slightly dampened cloth before applying retroreflective sheeting.

Abrade, clean, and degrease the face of the plywood panels using methods recommended by the retroreflective sheeting manufacturer before applying reflective sheeting. Treat plywood panel edges with sealant.

Join extruded aluminum panel sections with panel nuts, bolts, and washers to achieve the desired sign size. Use 6- and 12-inch (150- and 300-millimeter) plate heights to achieve the sign panel vertical dimensions in increments of 6 inches (150 millimeters). Do not include more than one 6-inch (150-millimeter) plate per sign.

Use retroreflective sheeting as specified and according to ASTM D4956. For roadside signs, use Type III, IV, VIII, IX, or XI prismatic retroreflective sheeting. Use fluorescent yellow sheeting for warning signs. Use fluorescent yellow-green sheeting for pedestrian, bicycle, and school crossing signs.

For multilane or overhead guide signs, use Type III or Type IV prismatic retroreflective sheeting for the background and Type IX or Type XI retroreflective sheeting for the legend.

For parking lot and non-roadway signs, Types I and Type II retroreflective sheeting may be used.

(2) Legends and borders. Form letters, numerals, and other units to provide a continuous stroke width with smooth edges. Make the surface flat and free of warp, blisters, wrinkles, burrs, and splinters. Do not fabricate letters, numerals, arrows, symbols, or borders using a red screen ink process.

Conform to one of the following techniques:

(a) Type L-1 (screen process). Apply letters, numerals, arrows, symbols, borders, and other features on the sign background by direct or reverse screen process. Apply messages and borders of a color darker than the sign background by the direct process. Apply messages and borders of a color lighter than the sign background by the reverse screen process.

Apply screen inks recommended by the ink manufacturer for use on the various types of retroreflective sheeting. Apply ink that has the same durability and color as specified for that type of retroreflective sheeting. Apply black screen ink until opaque on retroreflective sheeting.

Perform the screening in a manner to ensure a uniform color and tone, with sharply defined edges of legends and borders. Do not allow running, streaking, or sagging.

Air dry or bake the signs after screening according to manufacturer’s recommendations to provide a smooth hard finish.

(b) Type L-2 (transparent films). Apply letters, numerals, arrows, symbols, borders, and other features on the sign background with colored transparent films. Select durable, electronically cuttable films coated with a transparent pressure-sensitive adhesive protected by a removable liner. Use transparent films recommended by the manufacturer within the color requirements specified for the retroreflective sheeting.

(c) Type L-3 (direct applied characters). Cut letters, numerals, arrows, symbols, borders, and other features from black opaque or retroreflective sheeting of the color specified. Apply characters to the sign background according to the retroreflective sheeting manufacturer’s instructions. Use the same sheeting manufacturer for both the sign legend, border, and background.

Package sign panels in protective material and transport in a vertical position.

(b) Installation. Mount sign panels with the legend horizontal.

Use oversized bolt heads and neoprene or nylon washers for fastening plastic sign panels. Use antitheft fasteners where possible. Paint bolt heads, screw heads, and washers that are exposed on the sign face. Match the color of the paint to the color of the sheeting at the point where the fitting is exposed.

Turn sign panels 3 degrees away from the road in the direction of travel to reduce specular glare (mirror reflection).

Cover the sign face with an opaque material if a sign message is not applicable. Maintain the covering in good condition until the message becomes applicable. Do not use adhesive tape on the sign face.

633.06 Delineators and Object Markers. Attach delineators and object markers to posts according to the manufacturer's recommendation or as specified.

633.07 Removing and Resetting Permanent Traffic Control Devices. Remove and store existing traffic control devices to be reset as necessary. Replace traffic control devices damaged during removal, storage, and resetting.

633.08 Acceptance. Material for permanent traffic control devices will be evaluated under Subsections 106.02 and 106.03.

Installation of permanent traffic control devices will be evaluated under Subsections 106.02 and 106.04.

Excavation and backfill will be evaluated under Section 209.

Minor concrete will be evaluated under Section 601.

Measurement

633.09 Measure the Section 633 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When measuring sign panels by the square foot (square meter), measure front face. Measure each sign panel in a multiple configuration.

When measuring sign systems by the square foot (square meter), measure front face of each sign panel.

When measuring sign systems by the each, measure each system as one regardless of the number of sign panels.

A sign system includes the supports.

When measuring removing and resetting permanent traffic control device, measures after they are reset. Measure removing and resetting of sign systems as described above.

Payment

633.10 The accepted quantities will be paid at the contract price per unit of measurement for the Section 633 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 634. — PERMANENT PAVEMENT MARKINGS

Description

634.01 This work consists of applying paint, markings, and markers on finished pavement.

Pavement markings are designated as follows:

Type A – Solventborne traffic paint with Type 1 glass beads;

Type B – Waterborne traffic paint with Type 1 glass beads;

Type C – High-build waterborne traffic paint with Type 1 and Type 3 glass beads;

Type D – Epoxy markings with Type 1 glass beads;

Type E – Epoxy markings with Type 1 and Type 3 glass beads;

Type H – Thermoplastic markings with Type 1 glass beads;

Type I – Thermoplastic markings with Type 1 and Type 3 glass beads;

Type J – Preformed pavement marking tape; or

Type K – Nonreflectorized markings.

Material

634.02 Conform to the MUTCD and the following Subsections:

Epoxy markings	718.11
Epoxy resin adhesives	718.17
Glass beads	718.14
Pavement markers	718.15
Preformed pavement marking tape	718.13
Solventborne traffic paint	718.09
Thermoplastic markings	718.12
Waterborne traffic paint	718.10

Construction Requirements

634.03 General. Where existing and final pavement marking locations are identical, stake the limits of existing pavement markings before beginning pavement work.

Submit manufacturer’s MSDS and product data sheets at least 7 days before applying pavement markings. A field demonstration may be required to verify the adequacy of the material.

Ship marking material in suitable containers plainly marked with the following information as appropriate for the material being furnished:

(a) Manufacturer’s name and address;

(b) Name of product;

(c) Lot and batch numbers;

(d) Color;

(e) Net mass and volume of contents;

(f) Date of manufacture;

(g) Date of expiration;

(h) Statement of contents (if mixing of components is required);

(i) Mixing proportions and instructions; and

(j) Safety information.

Establish marking patterns or locations according to the MUTCD, plans, or state requirements. In curve widening areas, establish the edge line markings at the limits of the traveled way and the centerline markings equal distance between the edge lines.

Remove loose particles, dirt, tar, grease, and other deleterious material from the surface to be marked. Where markings are placed on rigid pavement less than 1-year old, clean the pavement of laitance and curing compounds.

Remove temporary pavement markings the same day permanent pavement markings are applied. Remove temporary and conflicting pavement makings according to Subsection 635.13 before applying permanent pavement markings.

Obtain approval before applying markings. Apply markings to a clean, dry surface, and according to the manufacturer's recommendations. Produce markings that are clean-cut and uniform in appearance by day and night.

Current state approved pavement marking material may be used, when approved by the CO. Submit proof of compliance with state specifications.

Apply glass beads immediately following paint or markings application to ensure adhesion.

Protect markings from traffic until dried to a no-tracking condition. Remove tracking marks, spilled marking material, markings in unauthorized areas, and defective markings.

634.04 Solventborne Traffic Paint (Type A). Apply paint when pavement and air temperatures are at 35 °F (2 °C) and rising. Do not heat the paint above 120 °F (49 °C). Spray paint at a 15 mil (0.38 millimeters) minimum wet film thickness or at a rate of 107 square feet per gallon (2.6 square meters per liter).

Apply Type 1 glass beads on the paint at a rate of 6 to 8 pounds per gallon (0.72 to 0.96 kilograms per liter) of paint.

On new asphalt pavements or new asphalt surface treatments, apply two applications of paint and glass beads. Apply second application after first application is track free.

634.05 Waterborne Traffic Paint (Type B and Type C). Apply paint when pavement and air temperatures are 50 °F (10 °C) and rising.

(a) Type B. Do not heat the paint above 120 °F (49 °C). Spray paint at a 15 mil (0.38 millimeters) minimum wet film thickness or at a rate of 107 square feet per gallon (2.6 square meters per liter).

Apply Type 1 glass beads on the paint at a rate of 6 to 8 pounds per gallon (0.72 to 0.96 kilograms per liter) of paint.

On new asphalt pavements or new asphalt surface treatments, apply two coats.

(b) Type C. Spray paint at 25 mil (0.63 millimeters) minimum wet film thickness or at a rate of 71 square feet per gallon (1.7 square meters per liter).

Use two bead dispensers. Apply Type 3 glass beads on the paint at a rate of 6 to 8 pounds per gallon (0.72 to 0.960 kilograms per liter) followed by Type 1 glass beads on the paint at a rate of 6 to 8 pounds per gallon (0.72 to 0.96 kilograms per liter) of paint.

634.06 Epoxy Markings (Types D and Type E). Apply epoxy when pavement and air temperatures are 35 °F (2 °C) and rising. Heat components as specified by the manufacturer. Apply at a 25 mil (0.63 millimeters) minimum dry film thickness or at a rate of 71 square feet per gallon (1.7 square meters per liter).

(a) Type D. Apply Type 1 glass beads on the epoxy at a rate of 6 to 8 pounds per gallon (0.72 to 0.96 kilograms per liter) of epoxy.

(b) Type E. Use two bead dispensers. Apply Type 3 glass beads on the epoxy at a rate of 6 to 8 pounds per gallon (0.72 to 0.96 kilograms per liter) of epoxy followed by Type 1 glass beads on the epoxy at a rate of 6 to 8 pounds per gallon (0.72 to 0.96 kilograms per liter) of epoxy.

634.07 Thermoplastic Markings (Type H and Type I). Apply thermoplastic when pavement and air temperatures are 50 °F (10 °C) and rising. Heat thermoplastic as specified by the manufacturer.

Apply an epoxy resin primer/sealer according to the thermoplastic manufacturer's recommendations when placing markings on rigid pavements or asphalt pavements more than 2-years old, oxidized, or having exposed aggregates.

Allow the primer/sealer to dry.

For edge lines, apply thermoplastic at 60 mil (1.5 millimeters) dry film thickness. For other lines, apply thermoplastic at 90 mil (2.3 millimeters) dry film thickness.

(a) Type H. Apply Type 1 glass beads on the thermoplastic at a rate recommended by the manufacturer.

(b) Type I. Use two bead dispensers. Apply Type 3 glass beads on the thermoplastic followed by Type 1 glass beads on the thermoplastic at rates recommended by the manufacturer.

634.08 Preformed Pavement Marking Tape (Type J). Install to form a durable, weather resistant bond to the pavement. Apply preformed markings according to the manufacturer's recommendations. Use preformed marking tape containing retroreflective beads.

634.09 Nonreflectorized Markings (Type K). Apply solvent borne or waterborne traffic paint without glass beads.

634.10 Pavement Markers. Install raised or recessed pavement markers when the pavement and air temperatures are 50 °F (10 °C) and rising. Apply pavement markers with an epoxy resin adhesive as recommended by the manufacturer when the pavement is dry. Space the markers according to the MUTCD and plans.

634.11 Acceptance. Material for permanent pavement markings will be evaluated under Subsections 106.02 and 106.03.

Placing of permanent pavement markings will be evaluated under Subsections 106.02 and 106.04.

Measurement

634.12 Measure the Section 634 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When pavement markings are measured by the linear foot (meter), measure the length of line applied along the centerline of each line applied regardless of color. Measure broken or dotted pavement lines from end to end of the line including gaps. Measure solid pavement lines from end to end of each continuous line. Measure line quantities based on a 4-inch (100-millimeter) wide line. For line widths greater than 4 inches (100 millimeters), adjust the measured length of line in the ratio of the required width to 4 inches (100 millimeters).

When pavement markings are measured by the square foot (square meter), measure the number of square feet (square meter) of line, symbol or letter marking based on the marking area shown in the plans. If not shown, measure the area of each marking in place to the nearest square foot (square meter).

Payment

634.13 The accepted quantities will be paid at the contract price per unit of measurement for the Section 634 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

PART 3:
APPENDIX

APPENDIX A:
GEOTECHNICAL REPORT

GEOTECHNICAL EXPLORATION REPORT
KAYENTA BUE ROUTE PHASE 1
KAYENTA, ARIZONA

PROJECT # 170074

Prepared by:
ATEK Engineering Consultants, LLC
111 South Weber Drive, Suite 1
Chandler, Arizona 85226

Expires 9/30/2018

June 2, 2017

June 2, 2017
ATEK Project #170074

Attention: Mr. Merwin T. Yellowhair, P.E., CFM, Principal Engineer
ARROWHEAD ENGINEERING, INC.
1 S. Church Ave., Ste. 1200
Tucson, AZ 85701

Re: Geotechnical Exploration Report

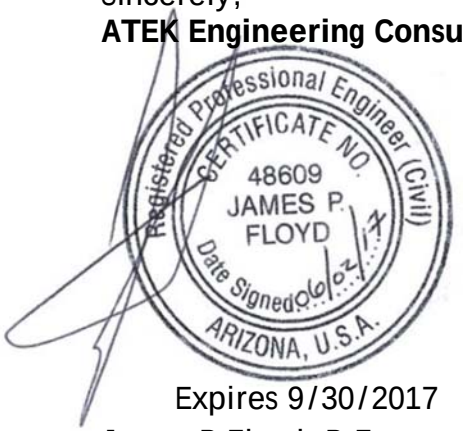
Project: Kayenta Bus Route Phase 1
Kayenta, Arizona

ATEK Engineering Consultants, LLC is pleased to present the attached report for the Geotechnical Exploration for the Kayenta Bus Route Phase 1 located in Kayenta, Arizona. The purpose of our study was to explore and evaluate the subsurface conditions at the proposed site to develop geotechnical engineering recommendations for project design and construction.

Based on our findings, the site is considered suitable for the proposed construction, provided geotechnical recommendations presented in the attached report are followed. Specific recommendations regarding the geotechnical aspects of the project design and construction are presented in the attached report. The recommendations contained within this report are dependent on the provisions provided in the Limitations and Recommended Additional Services sections of this report.

We appreciate the opportunity of providing our services for this project. If you have questions regarding this report or if we may be of further assistance, please contact the undersigned.

Sincerely,
ATEK Engineering Consultants, LLC



Expires 9/30/2017
James P Floyd, P.E.
Project Manager

Expires 9/30/2018
Armando Ortega, P.E.
Principal Geotechnical Engineer

TABLE OF CONTENTS

Expires 9/30/2018

atek
ENGINEERING CONSULTANTS

1. INTRODUCTION

This report presents the results of our geotechnical exploration for the Kaytena Bus Route Phase 1 located in Kayenta, Arizona. A Site Location Map is presented in **Appendix A**. The following sections of this report describe our understanding of the project and our scope of services.

1.1. Proposed Project

The proposed project consists of approximately 4,550 linear feet of a gravel surface roadway located in Kayenta, Arizona. It is understood that a geotechnical study was completed by Western Technologies on July 7, 2008 and the existing roadway was constructed in 2010 based on a conversation with the township. The surface of the gravel roadway appears to be deterating. A review of the existing geotechnical study and existing gravel surface has been requested. Additionally, sampling of the surface gravel and pavement subgrade has been requested to provide geotechnical recommendations for the proposed improvements. Proposed improvements will include paving the roadway with asphaltic concrete and possibly constructing a box culvert structure.

1.2. Purpose

The purpose of this geotechnical study was to evaluate the general surface and subsurface conditions at the site, and to present recommendations related to geotechnical aspects of design and construction of the proposed project.

1.3. Scope of Services

Our study included a review of Western Technologies Geotechnical Evaluation titled Kaytena Business Route, Kayenta, Arizona (Job number 2528JW169) dated July 7, 2008, site reconnaissance, subsurface exploration, soil sampling, field and laboratory

testing, engineering analyses, and preparation of this report. This report presents geotechnical recommendations for design and construction of proposed structures. The recommendations contained in this report are subject to the limitations presented herein. Attention is directed to the "Limitations" section of this report.

2. FIELD EXPLORATION

2.1. General

The field exploration was performed on May 11, 2017. Five soil borings were drilled to a depth of approximately three (3) feet below existing grade. The soil test borings were drilled using a gas engine powered auger. The borings were located in the field at the approximate locations shown on the Sample Location Plan included in **Appendix B** of this report.

Prior to the start of drilling, the Arizona Blue Stake Center was contacted to locate existing utilities at the boring locations. Upon completion of the borings, the boreholes were backfilled with excavated materials.

2.2. Soil Test Borings

Bulk samples were taken at the direction of the field engineer during drilling operations. The collected samples were sealed in bags to minimize moisture loss, and submitted to the laboratory.

Soil classifications made in the field from auger cuttings and samples were re-evaluated in the laboratory after further examination and testing. The soils were classified in accordance with the Unified Soil Classification System presented in **Appendix C**.

Sample classifications and other related information, were recorded on the soil boring logs. The boring logs are presented in **Appendix C**.

2.3. Surface Density Testing

Surface density testing was performed to provide information relative to the in-situ soil density. Two surface density tests were completed at each of the soil boring locations in accordance with Arizona Test Method (ARIZ) 235, *Field Density and Moisture Content of Soil and Soil-aggregate Mixtures by the Nuclear Method* and averaged. The following table presents the average of the surface density tests performed at each soil test boring location.

Test Location	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)
B-1	134.2	131.1	2.3
B-2	131.4	127.4	3.1
B-3	132.9	127.7	4.1
B-4	135.1	131.3	2.9
B-5	132.6	129.3	2.1

3. LABORATORY TESTING

Selected soil samples from the borings were tested in the laboratory for classification purposes and to evaluate their engineering properties. The laboratory tests included:

- Gradation;
- Atterberg limits;
- Moisture content;
- And R-value tests.

A brief description of each test performed on the soil samples and the results are presented in **Appendix D**.

4. GENERAL SITE CONDITIONS

4.1. Surface Conditions

The existing gravel surface road appears to be in relatively good condition with a few areas of wash boarding throughout the project limits. Visual evidence of loss of aggregate of the surface layer was also noted throughout the project alignment. The existing gravel surface had an averaged depth of approximately six and a half inches. The existing roadway was relatively flat. The v-ditches excavated along the north and south edges of the roadway appeared to be relatively clean. Evidence of rainwater runoff ponding was observed along the northwestern portion of the roadway's shoulder.

4.2. Subsurface Conditions

As indicated by the exploratory borings, in general the surface aggregate base course material classified as silty clayey sand with gravel (SC-SM), silty sand with gravel (SM), poorly graded gravel with silt and sand (GP-GM) and poorly graded sand with silt and gravel (SP-SM). The plasticity indexes of these soils ranged from non to low. The underlying subsurface soils encountered during our field exploration consisted of silty clayey sand (SC-SM) and clayey sand (SC). The plasticity indexes of these soils were found to be low. For additional information see Boring Logs presented in **Appendix C**.

4.3. Groundwater Conditions

Groundwater was not encountered within the soil test borings and it is anticipated that groundwater will not be a factor in design or construction of the planned improvements. It should be noted that soil moisture conditions within the area may vary depending on rainfall and/or runoff conditions not apparent at the time of our field study.

4.4. Geologic Hazards

4.4.1. Liquefaction Potential

Based on the site soils and groundwater conditions encountered at the project site during this study, the preliminary potential for soil liquefaction is considered to be negligible.

4.4.2. Expansive Soils

Expansive soils are soils with the potential for an increase in volume with an increase in moisture content. Based on the information collected during our field study and subsequent laboratory testing, we anticipate expansive-susceptible soils will be encountered during construction.

4.5. Seismic Considerations

The project site is located in northwestern Arizona which is an area of low seismic activity. The following values were developed using United States Geological Survey Earthquake Hazards Program (http://earthquake.usgs.gov/designmaps/us/application.php), the 2006 International Building Code (IBC) and are based on knowledge of local geologic conditions, and subsurface soils encountered during our study. A 100-foot soil test boring was not advanced during our field study. The geographic coordinates listed below were used in developing the seismic design factors.

Central Latitude.....36.7231˚
Central Longitude.....-110.2487˚

Seismic Design Factors	Value
Site Class	D
F_a, Site Coefficient	1.6
F_v, Site Coefficient	2.4
S_s, Mapped Spectral Acceleration at 0.2-second Period	0.210 g
S_1, Mapped Spectral Acceleration at 1.0-second Period	0.056 g
S_{MS}, Spectral Acceleration at 0.2-second Period Adjusted for Site Class	0.337 g
S_{M1}, Spectral Acceleration at 1.0-second Period Adjusted for Site Class	0.133 g
S_{DS}, Design Spectral Response Acceleration at 0.2-second Period	0.224 g
S_{D1}, Design Spectral Response Acceleration at 1.0-second Period	0.089 g

5. ENGINEERING ANALYSES AND RECOMMENDATIONS

5.1. Earthwork

All existing structural remnants, fill, pavement, topsoil, vegetation and organic soils should be removed from below structural areas. We present the following recommendations based on the finding of our field exploration, laboratory test results and engineering analysis.

5.1.1. Frost Heave

This project is located in an area with an anticipated frost depth of 30 inches. To protect against frost heave, the use of fine grained soils should be avoided in and around structural areas. The potential for snow pack in close proximity to the structural areas may allow significant moisture increase into fills around the outer edge of foundations therefore the exterior should be graded for positive drainage away from foundations. Also, to reduce potential for moisture migration through backfill, refer to section 5.5.

5.1.2. Box Culvert

The site soil should be removed to a depth of 12-inches below the bottom of the box culverts. The exposed subsurface soils should then be scarified to a depth of 8-inches: moisture conditioned to within 2 percent of optimum moisture content and compacted to a minimum of 95% of maximum dry density. Optimum moisture content and maximum dry density should be determined by ASTM D 698. The over excavation of site soils should be extend laterally for a minimum distance of 2-feet beyond the perimeter of structures.

5.1.3. Pavement Site Preparation and Grading

The following section present three subgrade preparation alternatives. The corresponding pavement section based on each alternative is presented in section 5.5 Pavement Areas of this report. The use of a filter fabric is not a structural requirement but should be considered to prevent the migration of fines from the subgrade into the aggregate base course (ABC) layer.

5.1.3.1. Replacement of Existing ABC (Option 1)

The subsurface fines have migrated into the existing aggregate base course. This reduces the support characteristics of the base material. This option blends the existing aggregate base with the existing subgrade to create the new subgrade for the pavement section. Additionally, this option includes new aggregate base and asphaltic concrete.

The existing roadway surface should be regraded to the finished subgrade elevation and excess aggregate base course material should be mixed with the existing subgrade soils. These soils should be scarified to a depth of 8-inches: moisture conditioned to within 3 percent of optimum moisture content and compacted to a minimum of 95 percent of maximum dry density. A new layer of aggregate base course material

should be placed as discussed in section 5.1.4. Note: a filter fabric as recommended in section 5.1.3 could be beneficial to reduce additional migration of fines into the new aggregate base layer. Optimum moisture content and maximum dry density should be determined by American Society for Testing and Materials (ASTM) Test Method D 698.

5.1.3.2. Using Existing ABC (Option 2)

The subsurface fines have migrated into the existing aggregate base course. This reduces the support characteristics of the base material. This option assumes using the existing aggerate base material and assigning a lower support value in pavement design, thus requiring additional asphaltic concrete to compensate for the lower support value.

The existing aggregate base course should be removed. The exposed subgrade should be scarified to a depth of 8-inches: moisture conditioned to within 3 percent of optimum moisture content and compacted to a minimum of 95 percent of maximum dry density. The excavated aggregate base course material should be placed as discussed in section 5.1.4. Optimum moisture content and maximum dry density should be determined by American Society for Testing and Materials (ASTM) Test Method D 698.

5.1.3.3. Cement Treatment of Existing ABC (Option 3)

This option would mix the existing aggregate base and surface soils and add cement to create an additional structural layer of support for the pavement section, thus reducing the thickness of the new aggerate base and asphaltic concrete layers.

The existing aggregate base course should be scarified to a depth of 8 inches and cement treated and compacted in accordance with Maricopa Association of Governments (MAG) Section 311. Our design is based on the mixture attaining a 7-day compressive strength of 300 psi.

5.1.4. Aggregate Base Course

Aggregate base used in support of Portland cement concrete and asphaltic concrete pavements should conform to the local governing agency and/or MAG Section 702 Specifications. The plasticity index of the fraction of material passing the No. 40 sieve should not exceed five when tested in accordance with ASTM Test Method D 4318. Coarse aggregate should have a percent of wear, when subjected to the Los Angeles abrasion test (ASTM Test Method C 131), of no greater than 40.

All aggregate base material should be placed in lifts not greater than eight inches and compacted to a minimum of 95 percent of maximum dry density below Portland cement concrete and 100 percent of maximum dry density below asphaltic concrete pavements as determined by American Society for Testing and Materials (ASTM) Test Method D 698 or as specified by local specification. The moisture content during compaction should be maintained within two percent of optimum moisture content.

5.1.5. Engineered Import Fill

Engineered import fill should be composed of imported soils meeting the requirements for imported soils presented below. Pea gravel and poorly-graded materials should not be used as engineered fill unless approved by the geotechnical engineer. All engineered fills should be compacted as noted in section 5.

1. Native soils or imported soils with low expansive potentials could be used as fill material for the following:
   - general site grading
   - foundation backfill
   - foundation areas
   - pavement areas

2. Imported soils (if required) should conform to the following:

Gradation	**Percent finer by weight (ASTM C136)**

3"……100

No. 4 Sieve……50-100

No. 200 Sieve……50 (max)

Liquid Limit……30 (max)

Plasticity Index……15 (max)

Swell Test

Maximum Swell Potential ……1.5 %*

*Measured on a sample compacted to approximately 95 percent of the ASTM D 698 maximum dry density at about 2 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

Corrosion Potential	**(PPM)**
Sulfate Content (ARIZ 733)……	1,000(max)
Chloride Content (ARIZ 736)……	500(max)

3. Aggregate base should conform to MAG and/or local governing specifications.

4. The following are intended to guide in establishing adequate support for the conventional foundation elements:
   - Any natural washes, depressions or new excavations which are to be filled, should be widened as necessary to accommodate compaction equipment and provide a level base for placing fill.
   - Any engineered fill (backfill) materials placed beneath the foundations should meet the requirements for Engineered Fill Materials.
   - All footing excavations should be relatively level and free of loose or disturbed material and inspected by a qualified representative of the Geotechnical Engineer.

5. All fill soils to be used beneath the foundations; slabs and pavements should be approved by the Geotechnical Engineer. Fill should be placed in 8-inch loose lifts, moisture conditioned and compacted as recommended in section 5.1 Earthwork.

5.2. Excavation

The field sampling and exploration was performed using a handheld solid stem auger. We present the following general comments regarding ease of excavation with the understanding that they are opinions based on the test borings. The project consultant and contractor should become familiar with this report including boring logs to evaluate potential hard dig conditions. **Please note that excavation characteristics are best evaluated by performing test excavations with the size and type of equipment the contractor plans on using at the site, which was not conducted as part of this study.**

It is anticipated that shallow excavations in the site soils can most likely be accomplished by conventional earth moving equipment in good operating condition. Sloughing and caving of near surface soils should be considered during grading operations. Please refer to Section 4 and the boring logs presented in **Appendix C** of this report for more information.

5.2.1. Trench Backfill

Materials

Pipe zone backfill (i.e., material beneath and in the immediate vicinity of the pipe) should consist of soil with a maximum particle size less than one inch. Trench zone backfill (i.e., material placed between the pipe zone backfill and finished subgrade) may consist of soil that meets the requirements for structural fill provided above.

If import material is used for pipe or trench zone backfill, we recommend it consist of fine-grained sand. In general, poorly graded coarse-grained sand and gravel should not be used for pipe or trench zone backfill due to the potential for site soil migration into the relatively large void spaces present in this type of material and water seepage along trenches backfilled with coarse-grained sand and/or gravel.

Recommendations provided above for pipe zone backfill are minimum requirements only. More stringent material specifications may be required to fulfill local codes and/or bedding requirements for specific types of pipes. We recommend the project Civil Engineer develop these material specifications based on planned pipe types, bedding conditions, and other factors beyond the scope of this study.

Compaction Criteria

Backfill of trenches should utilize site soils with particle diameter less than 3-inches, in order to aid compaction and reduce potential differential settlement problems. Backfilling of utility trenches should be in 12-inch maximum loose lifts, and compacted to a minimum of 90 percent and 95 percent of ASTM D-698 (standard Proctor), in non-structural areas and structural areas, respectively. Please note that the local governing agency specifications may surpass these trenches backfill requirements. Jetting, flooding, or puddling of cohesive backfill soils should not be utilized under any circumstances.

5.2.2. Temporary Excavations

General

All excavations must comply with applicable local, state, and federal safety regulations including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. Generally, Construction site safety is solely the responsibility of the Contractor, who shall also be responsible for the means, methods, and sequencing of construction operations. We are providing the information below strictly as a service to our client. Under no circumstances should

the information be interpreted that ATEK is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

Excavations and Slopes

The Contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced; and, if not followed, could result in substantial penalties to the Owner, Contractor, and/or earthwork subcontractor and/or utility subcontractors.

Near-surface soils encountered during our field study consisted predominantly of silty clayey sands. In our opinion, these soils would be considered a Type B soil when applying OSHA regulations. For this soils type OSHA recommends a maximum slope inclination of 1(h):1(v) or flatter for excavations 20 feet or less in depth. Steeper cut slopes may be utilized for excavations less than 5 feet deep depending on the strength, moisture content, and homogeneity of the soils as observed in the field. Flatter slopes and/or trench shields may be required if loose, cohesionless soils and/or water are encountered along the slope face.

Construction Considerations

Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within one-third the slope height from the top of any excavation. Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. Shoring, bracing, or underpinning required for the

project (if any) should be designed by a professional engineer registered in the State of Arizona.

During wet weather, earthen berms or other methods should be used to prevent runoff water from entering all excavations. All runoff water should be collected and disposed of outside the construction limits.

5.3. Structures

The anticipated frost depth for the project area is 30-inches below existing site grade. Therefore, foundations should have turn downs which extend below the anticipated frost depth.

5.3.1. Mat Foundation

Mat foundations bearing on engineered fill as presented in section 5.1.2 of this report may be used to support the proposed structures. An allowable bearing pressure of 2,000 pounds per square foot may be used for mat foundations. A one third increase may be applied to the recommended bearing pressure when considering short duration loads, such as wind and seismic.

A modulus of subgrade reaction of 500 kips per cubic foot (kcf) should be used for the design of the mat foundation. This value is based on a 1-foot square bearing area and needs to be scaled to account for mat foundation size effects. To obtain the modulus of subgrade reaction for a given mat foundation, the value of 500 kcf should be divided by the width of the effective loaded area, in feet. We estimate that the long-term total and differential settlement of new mat foundations constructed as recommended in this report should be on the order of 1-inch.

5.3.2. Resistance to Lateral Loads

Proposed walls/structures that will retain soil must be designed to withstand lateral soil pressures. Cantilevered retaining walls, or unrestrained walls subject to lateral earth pressures, should be designed for an equivalent fluid pressure (EFP) of 40 PCF. Restrained walls should be designed to withstand a residual or long-term at-rest (Ko) earth pressure condition of 58 pounds per cubic foot (PCF).

A passive EFP of 305 PCF may be used for shallow spread footings. A coefficient of friction of 0.34 is recommended for computing lateral resistance between the base of footing and soil in analyzing lateral loads. Vehicular surcharge loads and/or hydrostatic pressure will increase the recommended EFP.

Only cohesionless, free-draining granular materials should be used as backfill, adjacent to earth-retaining structures. We recommend that backfill directly behind the walls be compacted with light, hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within 3 feet of the walls during backfilling, to avoid developing excessive temporary or long-term lateral soil pressures. Positive gravity drainage of the backfill should be provided.

5.4. Moisture Protection

Positive drainage is essential to the successful performance of any structure. Good surface and subsurface drainage should be established during and after construction to prevent the soils below or adjacent to the structural areas and utility trenches from becoming wet.

Infiltration of water into utility or foundation excavations must be prevented during construction. The drainage design must route all storm and sprinkler water away from the structural areas in a positive manner. All water should be diverted away from areas where it could penetrate the ground surface near the structural areas.

Watering of plants should be avoided adjacent to the buildings. Desert-type landscaping is advisable near the structural areas. Plants, which require more water, should be located and drained away from the structural areas.

5.5. Pavement Areas

The on-site soils should be suitable as pavement subgrade soils provided all unsuitable debris, rubble, oversized cobbles, etc. are removed. A flexible pavement is recommended for the pavement areas. The recommended pavement sections are based on the assumption that the subgrade soils are prepared in accordance with section 5.1 of this report.

The flexible pavement section should consist of Central Plant Mix Asphaltic Concrete Pavement (AC) on compacted Aggregate Base Course (ABC) as recommended in the table below. Flexible pavement should be placed in accordance with MAG Section 321 and local municipality standards.

5.5.1. Traffic

The total 18-kip equivalent single axle load (ESAL) of 219,000 for a Minor Collector and 438,000 for a Major Collector, as provided in the previously referenced report, were used in design.

5.5.2. R-Value

The soil sampled during the field portion of this project consisted primarily of silty clayey sands. One R-value test was performed on a bulk sample obtained during the field study. The average resulting R-value was 12. The plasticity index and percent passing the number 200 sieve where also determined on five separate samples obtain during the field study. Correlated R-values were determined using table 202.02-3 of the Arizona Department of Transportation *Preliminary Engineering and Design*

Manual. The resulting average correlated R-value of 44 was determined. For the purpose of this pavement design a design R-value of 16 was used for design.

5.5.3. Resilient Modulus

Based on a design R-value of 16 and a seasonal variation factor of 1.8 a design subgrade resilient modulus of 7,229 psi was used to represent the native soil sampled and tested during our field study.

5.5.4. Drainage Coefficient

A drainage coefficient of 0.85 used based on Table 202.02-7 of the of the Arizona Department of Transportation *Preliminary Engineering and Design Manual*.

5.5.5. Recommended Structural Number

Please refer to **Appendix E** for additional parameters used in design. Summary of the target structural number and design section structural number are presented below:

PAVEMENT AREA		ASPHALTIC CONCRETE (IN)	AGGREGATE BASE COURSE (IN)	CEMENT TREATED SUBGRADE (IN)	STRUCTURAL NUMBER (SN)	TARGET STRUCTURAL NUMBER (SN)
Minor Collector	Option 1	4.0	8.0	--	2.64	2.55
	Option 2	5.0	6.0	--	2.70	2.55
	Option 3	3.0	4.0	8.0	3.18	2.55
Major Collector	Option 1	5.0	7.0	--	2.94	2.88
	Option 2	5.5	6.0	--	2.91	2.88
	Option 3	3.0	4.0	8.0	3.18	2.88

Our calculations for design of the pavements section is based upon our classification of the subsurface soils, the calculated traffic in 18 kips equivalent single axle loads,

the site preparation and grading recommendations provided above. Note: the existing ABC material in place has had some infiltration of fines, therefore a structural coefficient of 0.10 was used based on an evaluation of the field samples collected. The use of a filter fabric is not a structural requirement but should be considered to prevent the migration of fines from the subgrade into the aggregate base course (ABC) layer.

6. CLOSURE

6.1. Limitations

Our professional services have been performed using that degree and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Engineers practicing in this or similar localities. No warranty is expressed or implied.

The recommendations contained in this report are based on our field exploration, laboratory test results, and our understanding of the proposed construction. The subsurface data used in the preparation of this report was obtained from the test borings excavated during the field subsurface exploration. It is anticipated that some variations in the soil conditions will exist on-site. The nature and extent of variations may not be evident until construction occurs. If any conditions are encountered at this site that are different from those described in this report, we should be immediately notified so that we may make any necessary revisions to the recommendations contained in this report. In addition, if the scope of the proposed construction changes from that described in this report, our firm should also be notified.

It is the Client's responsibility to see that all parties to the project including the designer, contractor, subcontractor, etc. are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

This report is for the exclusive purpose of providing Geotechnical Engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken. This report has also not addressed the site geology and the possible presence of geologic hazards.

This report may be used only by the Client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on and off-site), or other factors may change over time, and additional work may be required with the passage of time. Any party, other than the Client, who wishes to use this report, shall notify ATEK of such intended use. Based on the intended use of this report, ATEK may require that additional work be performed and that an updated report be issued.

6.2. Recommended Additional Services

The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be performed during the construction. These tests and observations should be performed by the Geotechnical Engineer's representative and should include, but not limited to the following:

- Observe and document that any existing surficial vegetation and other deleterious materials have been removed from the site as required in site preparation section.
- Approve any material used as import to document that it meets the requirements outlined above before placement.
- Monitor the backfill procedures.
- Perform field density tests, as needed, to verify compaction compliance. The

representative should monitor the progress of compaction and filling operations.

- Keep records of on-site activities and progress.

Observation of footing excavations should be performed prior to placement of reinforcing and concrete to confirm that satisfactory bearing materials are present. Construction testing, including field and laboratory evaluation of fill and backfill materials, concrete and steel should be performed to determine whether applicable project requirements have been met.

APPENDIX A
Site Location Map

Project Site

N

Site image from earth.google.com.

*Note: not to scale.

Site Location Map

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Sheet 1 of 1

ATEK Engineering Consultants, LLC
111 South Weber Drive, Suite 1
Chandler, AZ 85226

Kayenta Bue Route Phase 1	
Project Number:	170074
Date:	June 2, 2017
Drawn By:	J Floyd

APPENDIX B
Sample Location Plan

atek
ENGINEERING CONSULTANTS

N

Legend:

Soil Test Boring

Site image from earth.google.com.

*Note: not to scale.

Sample Location Plan

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Sheet 1 of 1

ATEK Engineering Consultants, LLC
111 South Weber Drive, Suite 1
Chandler, AZ 85226

Kayenta Bue Route Phase 1	
Project Number:	170074
Date:	June 2, 2017
Drawn By:	J Floyd

APPENDIX C
FIELD STUDY AND BORING LOGS

APPENDIX C
FIELD STUDY

BORINGS

The subsurface conditions at the site were explored on May 11, 2017, by drilling soil borings using a handheld solid stem auger. The locations of soil test borings performed for this study are shown in **Appendix B** of this report.

The locations of borings were located by visual sighting and pacing from existing site features and, therefore, should be considered approximate. Actual boring locations may vary from those indicated in **Appendix B**.

Our field engineer maintained a log of the excavations; visually classified soils encountered according to the Unified Soil Classification System (USCS) (see USCS Table); and obtained samples of the subsurface materials.

SAMPLING PROCEDURES

Soil samples obtained from the borings were packaged and sealed in the field to reduce moisture loss and disturbance, and returned to our laboratory for further testing. After borings were completed, they were backfilled with the excavated soils.

LIST OF ATTACHMENTS

The following plates are attached and complete this appendix.

Unified Soil Classification System – C1
Log Key – C2
Charts and Definitions – C3
Terminology Used to Describe Soils – C4
Logs of Soil Borings

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			USCS SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	GRAVELS (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH LESS THAN 5% PASSING NO. 200 SIEVE	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH OVER 12% PASSING NO. 200 SIEVE	GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH LESS THAN 5% PASSING NO. 200 SIEVE	SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH OVER 12% PASSING NO. 200 SIEVE	SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid limit less than 50)		ML	INORGANIC SILTS & VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid limit greater than 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

Note: Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing No. 200 sieve require dual USCS symbols. (See KEY A-3 if provided)

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Drafted By: JF

Date: June 1, 2017

Project Number: 170074

UNIFIED SOIL CLASSIFICATION SYSTEM

Kayenta Bus Route Phase 1
Arrowhead Engineering, Inc
Kayenta, Arizona

KEY

C-1

LOG SYMBOLS

BULK / GRAB SAMPLE

MODIFIED CALIFORNIA SAMPLER
(2 inch inside diameter)

GRAB SAMPLE

STANDARD PENETRATION
SPLIT SPOON SAMPLER
(2.0-inch O.D. X 1.4-inch I.D.)

SHELBY TUBE
(3 inch outside diameter)

NON-STANDARD PENETRATION
SPLIT SPOON SAMPLER
(1.5-inch O.D. X 0.9-inch I.D.)

BDBGM SIZE CORE BARREL
(1.65-inch I.D.)

BW44 SIZE CORE BARREL
(1.75-inch I.D.)

HQ-3 SIZE CORE BARREL
(2.4-inch I.D.)

WATER LEVEL
(level after completion)

WATER LEVEL
(level where first encountered)

GENERAL NOTES

1. Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.

2. No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.

3. Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.

4. In general, the Unified Soil Classification designations presented on the logs were based on visual classification in the field, modified where appropriate by visual classifications in the office, and/or laboratory gradation and index testing.

5. NA = Not Analyzed

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Drafted By: JF	Project Number:
Date: June 1, 2017	170074

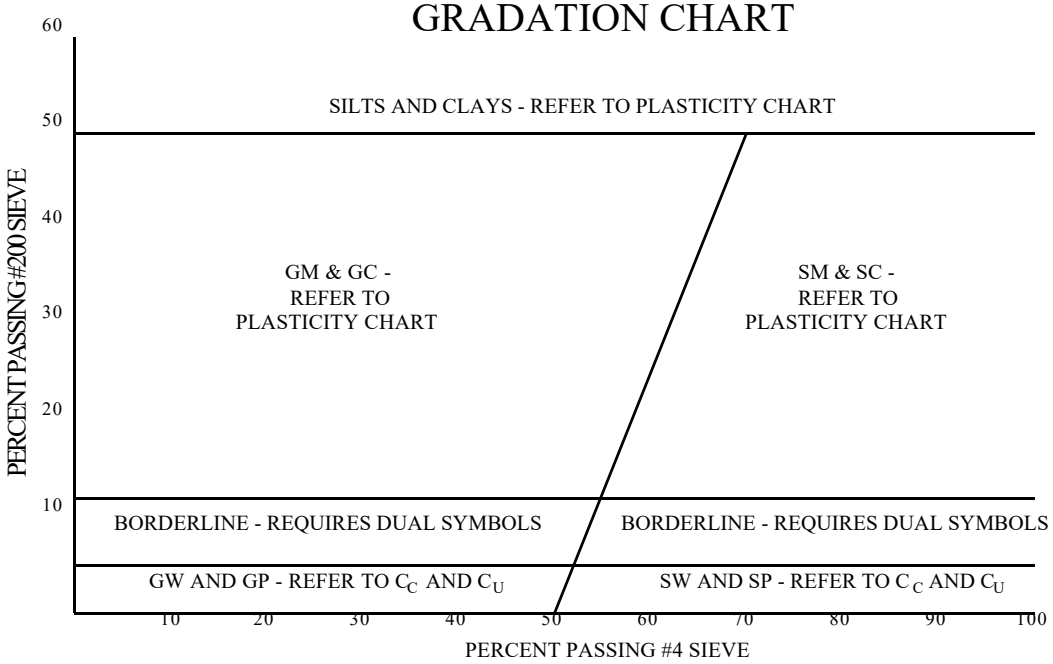
LOG KEY

Kayenta Bus Route Phase 1
Arrowhead Engineering, Inc
Kayenta, Arizona

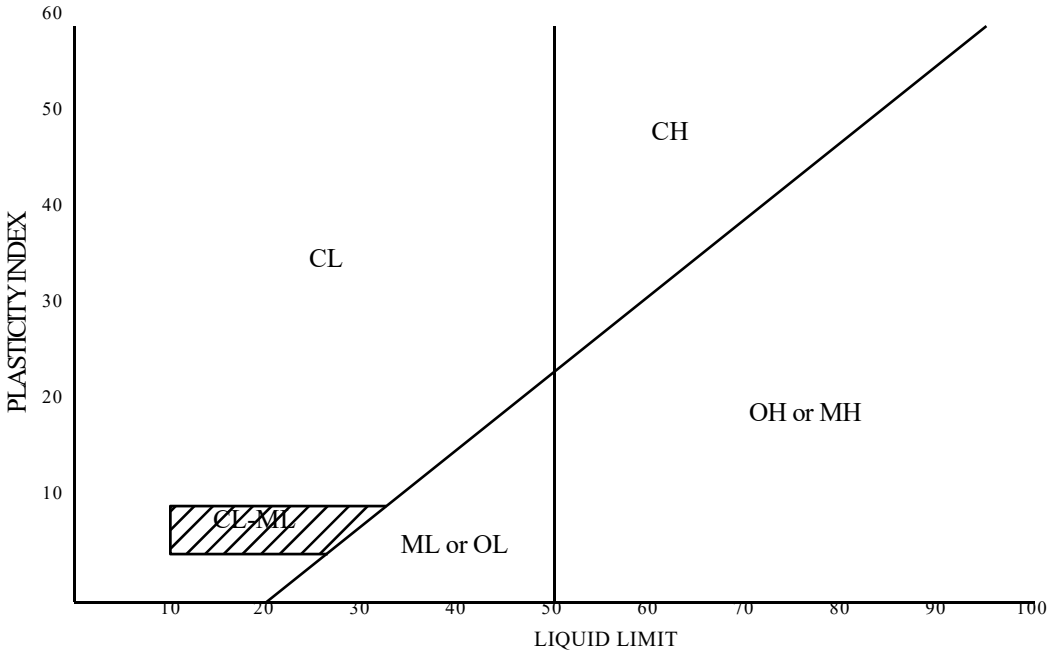
KEY

C-2

GRADATION CHART



PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL FRACTION	PARTICLE SIZE RANGE
Boulders	Greater than 300mm (12in.)
Cobbles	300mm to 75mm (12in. to 3in.)
Coarse Gravel	75mm to 19mm (3in. to 3/4in.)
Fine Gravel	19mm (3/4in.) to No. 4 sieve
Coarse Sand	No. 4 sieve to No. 10 sieve
Medium Sand	No. 10 sieve to No. 40 sieve
Fine Sand	No. 40 sieve to No. 200 sieve
Fines	less than No. 200 sieve

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Drafted By: JF

Date: June 1, 2017

Project Number: 170074

CHARTS & DEFINITIONS

Kayenta Bus Route Phase 1
Arrowhead Engineering, Inc
Kayenta, Arizona

KEY

C-3

TERMINOLOGY USED ON THE BORING LOGS TO DESCRIBE
THE FIRMNESS, DENSITY, OR CONSISTENCY OF SOILS

The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586 procedure using 2" O.D., 1 3/8" I.D. samplers.

1. Terms for description of partially saturated and/or cemented soils including clays, cemented granular materials, silts and silty and clayey granular soils.

N	Relative Firmness
0 - 4	Very soft
5 - 8	soft
9 - 15	Moderately firm
16 - 30	Firm
31 - 50	Very firm
51+	Hard

2. Terms for description of cohesionless, uncemented sands and sand-gravel mixtures.

N	Relative Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium dense
31 - 50	Dense
51+	Very dense

3. Terms for description of clays which are saturated or near saturation.

N	Relative Consistency
0 - 2	Very soft
3 - 4	soft
5 - 8	Moderately stiff
9 - 15	Stiff
16 - 30	Very Stiff
31+	Hard

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Drafted By: JF
Date: June 1, 2017

Project Number: 170074

TERMINOLOGY USED TO DESCRIBE SOILS

Kayenta Bus Route Phase 1
Arrowhead Engineering, Inc
Kayenta, Arizona

KEY

C-4

Project Name: Kayenta Bus Route	Client: ARROWHEAD Engineering, Inc.		
Testpit Location: See Sample Location Plan			Sheet 1 of 1
Testpit Number: B-1	Excavation Contractor: ATEK		Logger: J Floyd
Excavation Equipment: Hand Held Auger	Bucket Size (in.): 4 SSA	Date Started: 5/11/17	Date Finished: 5/11/17

Elevation and Datum: Ground:

Notes:

DEPTH (ft)	EXCAVATION OPERATION	SAMPLE	INPLACE NUCLEAR DENSITY TEST (pcf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT LL	PLASTICITY INDEX PI	-200 (%)	USCS CLASSIFICATION	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	REMARKS
				1.6		16	4	17	SC-SM		SILTY CLAYEY SAND WITH GRAVEL (SC-SM), 38% coarse to fine graded gravel, 45% coarse to fine grained sand, 17% fines, subangular, 3/4" dia, low plasticity, reddish brown, moist, no cementation, no reaction to HCl, AGGREGATE BASE COURSE (approximately 6.5-inches thick)	0.5	
				3.0		20	6	41	SC-SM		SILTY CLAYEY SAND (SC-SM), 1% fine graded gravel, 58% coarse to fine grained sand, 41% fines, subrounded, low plasticity, reddish brown, moist, no cementation, no reaction to HCl		
2												3	

Bottom of Boring @ 3 feet bgs.
No groundwater encountered.

Sampler Types:
- Test Pit
- Bulk Sample
- Grab Sample

Operation Types:
- Excavated Pit

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WATER LEVEL OBSERVATIONS

While Drilling ▽ N/A ft	Upon Completion of Drilling ▼ N/A ft			
Time After Drilling	N/A	N/A	N/A	N/A
Depth To Water (ft)	N/A	N/A	N/A	N/A ▼

Remarks: Not Encountered

ATEK Project Number:		
170074	ATEK Engineering Consultants 111 South Weber Drive, Suite 1 Chandler, Arizona 85226	**LOG OF TESTPIT B-1**

Fig.

170074 KAYENTA BUS ROUTE PHASE 1.GPJ ` 6-1-17 ` J Floyd ` ATEK TESTPIT (W/REMARKS-SH#-SAME FIG#) `

Revised 10-14-11 (MAT)

Project Name: Kayenta Bus Route	Client: ARROWHEAD Engineering, Inc.		
Testpit Location: See Sample Location Plan			Sheet 1 of 1
Testpit Number: B-2	Excavation Contractor: ATEK		Logger: J Floyd
Excavation Equipment: Hand Held Auger	Bucket Size (in.): 4 SSA	Date Started: 5/11/17	Date Finished: 5/11/17

Elevation and Datum: Ground:

Notes:

DEPTH (ft)	EXCAVATION OPERATION	SAMPLE	INPLACE NUCLEAR DENSITY TEST (pcf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT LL	PLASTICITY INDEX PI	-200 (%)	USCS CLASSIFICATION	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	REMARKS
				1.6		NV	NP	14	SM		SILTY SAND WITH GRAVEL (SM), 39% coarse to fine graded gravel, 47% coarse to fine grained sand, 14% fines, subangular, 3/4" dia, non plastic, reddish brown, moist, no cementation, no reaction to HCl, AGGREGATE BASE COURSE (approximately 6-inches thick)	0.5	
2				3.6		21	6	39	SC-SM		SILTY CLAYEY SAND (SC-SM), 61% coarse to fine grained sand, 39% fines, subrounded, low plasticity, reddish brown, moist, no cementation, no reaction to HCl	3	

Bottom of Boring @ 3 feet bgs.
No groundwater encountered.

Sampler Types:
- Test Pit
- Bulk Sample
- Grab Sample

Operation Types:
- Excavated Pit

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WATER LEVEL OBSERVATIONS

While Drilling ▽ N/A ft	Upon Completion of Drilling ▼ N/A ft			
Time After Drilling	N/A	N/A	N/A	N/A
Depth To Water (ft)	N/A	N/A	N/A	N/A ▼

Remarks: Not Encountered

ATEK Project Number:		
170074	ATEK Engineering Consultants 111 South Weber Drive, Suite 1 Chandler, Arizona 85226	**LOG OF TESTPIT B-2**

Fig.

170074 KAYENTA BUS ROUTE PHASE 1.GPJ ` 6-1-17 ` J Floyd ` ATEK TESTPIT (W/REMARKS-SH#-SAME FIG#) `

Revised 10-14-11 (MAT)

Project Name: Kayenta Bus Route	Client: ARROWHEAD Engineering, Inc.		
Testpit Location: See Sample Location Plan			Sheet 1 of 1
Testpit Number: B-3	Excavation Contractor: ATEK		Logger: J Floyd
Excavation Equipment: Hand Held Auger	Bucket Size (in.): 4 SSA	Date Started: 5/11/17	Date Finished: 5/11/17

Elevation and Datum: Ground:

Notes:

DEPTH (ft)	EXCAVATION OPERATION	SAMPLE	INPLACE NUCLEAR DENSITY TEST (pcf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT LL	PLASTICITY INDEX PI	-200 (%)	USCS CLASSIFICATION	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	REMARKS
2				1.4		NV	NP	11	GP-GM		POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM), 47% coarse to fine graded gravel, 42% coarse to fine grained sand, 11% fines, subangular, 1" dia, non plastic, reddish brown, moist, no cementation, no reaction to HCl, AGGREGATE BASE COURSE (approximately 7-inches thick)	0.6	
				4.7		22	9	40	SC		CLAYEY SAND (SC), 60% coarse to fine grained sand, 40% fines, subrounded, low plasticity, reddish brown, moist, no cementation, no reaction to HCl	3	

Bottom of Boring @ 3 feet bgs.
No groundwater encountered.

Sampler Types:
- Test Pit
- Bulk Sample
- Grab Sample

Operation Types:
- Excavated Pit

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WATER LEVEL OBSERVATIONS

While Drilling ▽ N/A ft	Upon Completion of Drilling ▼ N/A ft			
Time After Drilling	N/A	N/A	N/A	N/A
Depth To Water (ft)	N/A	N/A	N/A	N/A ▼

Remarks: Not Encountered

ATEK Project Number:		
170074	ATEK Engineering Consultants 111 South Weber Drive, Suite 1 Chandler, Arizona 85226	**LOG OF TESTPIT B-3**

Fig.

170074 KAYENTA BUS ROUTE PHASE 1.GPJ ` 6-1-17 ` J Floyd ` ATEK TESTPIT (W/REMARKS-SH#-SAME FIG#) `

Revised 10-14-11 (MAT)

Project Name: Kayenta Bus Route	Client: ARROWHEAD Engineering, Inc.		
Testpit Location: See Sample Location Plan			Sheet 1 of 1
Testpit Number: B-4	Excavation Contractor: ATEK		Logger: J Floyd
Excavation Equipment: Hand Held Auger	Bucket Size (in.): 4 SSA	Date Started: 5/11/17	Date Finished: 5/11/17

Elevation and Datum: Ground:

Notes:

DEPTH (ft)	EXCAVATION OPERATION	SAMPLE	INPLACE NUCLEAR DENSITY TEST (pcf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT LL	PLASTICITY INDEX PI	-200 (%)	USCS CLASSIFICATION	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	REMARKS
				10.0		NV	NP	7	SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), 46% coarse to fine graded gravel, 47% coarse to fine grained sand, 7% fines, subangular, 3/4" dia, non plastic, reddish brown, moist, no cementation, no reaction to HCl, AGGREGATE BASE COURSE (approximately 6.5-inches thick)	0.5	
2				4.2		22	9	44	SC		CLAYEY SAND (SC), 1% fine graded gravel, 55% coarse to fine grained sand, 44% fines, subrounded, low plasticity, reddish brown, moist, no cementation, no reaction to HCl	3	

Bottom of Boring @ 3 feet bgs.
No groundwater encountered.

Sampler Types:
- Test Pit
- Bulk Sample
- Grab Sample

Operation Types:
- Excavated Pit

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WATER LEVEL OBSERVATIONS

While Drilling ▽ N/A ft	Upon Completion of Drilling ▼ N/A ft			
Time After Drilling	N/A	N/A	N/A	N/A
Depth To Water (ft)	N/A	N/A	N/A	N/A ▼

Remarks: Not Encountered

ATEK Project Number:		
170074	ATEK Engineering Consultants 111 South Weber Drive, Suite 1 Chandler, Arizona 85226	**LOG OF TESTPIT B-4** Fig.

170074 KAYENTA BUS ROUTE PHASE 1.GPJ ` 6-1-17 ` J Floyd ` ATEK TESTPIT (W/REMARKS-SH#-SAME FIG#) `

Revised 10-14-11 (MAT)

Project Name: Kayenta Bus Route	Client: ARROWHEAD Engineering, Inc.		
Testpit Location: See Sample Location Plan			Sheet 1 of 1
Testpit Number: B-5	Excavation Contractor: ATEK		Logger: J Floyd
Excavation Equipment: Hand Held Auger	Bucket Size (in.): 4 SSA	Date Started: 5/11/17	Date Finished: 5/11/17

Elevation and Datum: Ground:

Notes:

DEPTH (ft)	EXCAVATION OPERATION	SAMPLE	INPLACE NUCLEAR DENSITY TEST (pcf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT LL	PLASTICITY INDEX PI	-200 (%)	USCS CLASSIFICATION	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft)	REMARKS
2				1.1		NV	NP	12	SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), 40% coarse to fine graded gravel, 48% coarse to fine grained sand, 12% fines, subangular, 3/4" dia, non plastic, reddish brown, moist, no cementation, no reaction to HCl, AGGREGATE BASE COURSE (approximately 6-inches thick)	0.5	
				3.7		21	4	35	SC-SM		SILTY CLAYEY SAND (SC-SM), 65% coarse to fine grained sand, 36% fines, subrounded, low plasticity, reddish brown, moist, no cementation, no reaction to HCl	3	

Bottom of Boring @ 3 feet bgs.
No groundwater encountered.

Sampler Types:
- Test Pit
- Bulk Sample
- Grab Sample

Operation Types:
- Excavated Pit

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WATER LEVEL OBSERVATIONS

While Drilling ▽ N/A ft	Upon Completion of Drilling ▼ N/A ft			
Time After Drilling	N/A	N/A	N/A	N/A
Depth To Water (ft)	N/A	N/A	N/A	N/A ▼

Remarks: Not Encountered

ATEK Project Number:		
170074	ATEK Engineering Consultants 111 South Weber Drive, Suite 1 Chandler, Arizona 85226	**LOG OF TESTPIT B-5**

Fig.

170074 KAYENTA BUS ROUTE PHASE 1.GPJ ` 6-1-17 ` J Floyd ` ATEK TESTPIT (W/REMARKS-SH#-SAME FIG#) `

Revised 10-14-11 (MAT)

APPENDIX D
Laboratory Test

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APPENDIX D
LABORATORY TESTING

LABORATORY TESTS

Laboratory tests were performed on selected samples to aid in soil classification and to evaluate physical properties of the soils, which may affect the Geotechnical aspects of project design and construction. A description of the laboratory testing program is presented below.

Sieve Analysis

Sieve analyses were performed to evaluate the gradation characteristics of the material and to aid in soil classification. Tests were performed in general accordance with ASTM Test Method C 136 and D 2487.

Atterberg Limits

Atterberg Limits tests were performed to aid in soil classification and to evaluate the plasticity characteristics of the material. Additionally, test results were correlated to published data to evaluate the shrink/swell potential of near-surface site soils. Tests were performed in general accordance with ASTM Test Method D 4318.

Moisture Content

Moisture content tests were performed to evaluate moisture-conditioning requirements during site preparation and earthwork grading. Moisture content was evaluated in general accordance with ASTM Test Method D 2216.

R-Value

Resistance R-value test were performed to evaluate potential strength of subgrade site soils. R-value tests were performed in general accordance with ASTM Test Method D 2844.

Standard Proctor

Proctor test was performed on a bulk soil sample to evaluate the optimum moisture and maximum dry density of the site soils. Test procedures were in general accordance with ASTM Test Method D 698A.

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PROJECT: Kayenta Bus Route
LOCATION: Kayenta, AZ
DATE SAMPLED: 5/11/2017

PROJECT NO: 170074
WORK ORDER NO: 1710072
REVIEWED BY: J Floyd

MECHANICAL SIEVE ANALYSIS
GROUP SYMBOL, USCS (ASTM D-2487)

SIEVE SIZES

					COBBLES		GRAVEL									SAND								Silt or Clay	
							Coarse					Fine				Coarse		Medium			Fine				
Location & Depth	USCS	LL	PL	PI	6"	4"	3"	2"	1 1/2"	1 1/4"	1"	3/4"	1/2"	3/8"	1/4"	#4	#8	#10	#16	#30	#40	#50	#100	#200	Lab #

PERCENT PASSING BY WEIGHT

Bulk Sample, B-1 @ 0.0'-0.5'	SC-SM	16	12	4	100	100	100	100	100	100	100	94	79	72	66	62	55	53	49	44	37	30	23	17	1
Bulk Sample, B-1 @ 0.5'-3.0'	SC-SM	20	14	6	100	100	100	100	100	100	100	100	100	100	100	99	99	99	99	99	97	93	71	41	2
Bulk Sample, B-2 @ 0.0'-0.5'	SM	NV	NP	NP	100	100	100	100	100	100	100	97	83	74	65	61	55	53	48	42	33	24	18	14	3
Bulk Sample B-2 @ 0.5'-3.0'	SC-SM	21	15	6	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	99	98	94	76	39	4
Bulk Sample, B-3 @ 0.0'-0.6'	GP-GM	NV	NP	NP	100	100	100	100	100	100	99	97	78	68	57	53	45	44	39	34	26	19	14	11	5
Bulk Sample, B-3 @ 0.6'-3.0'	SC	22	13	9	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	98	94	72	40	6
Bulk Sample, B-4 @ 0.0'-0.5'	SP-SM	NV	NP	NP	100	100	100	100	100	100	100	94	79	68	58	54	46	44	40	33	25	17	10	6.9	7
Bulk Sample, B-4 @ 0.5'-3.0'	SC	22	13	9	100	100	100	100	100	100	100	100	100	100	99	99	99	99	98	97	95	92	74	44	8
Bulk Sample, B-5 @ 0.0'-0.5'	SP-SM	NV	NP	NP	100	100	100	100	100	100	100	97	84	76	65	60	50	48	43	38	32	25	17	12	9
Bulk Sample, B-5 @ 0.5'-3.0'	SC-SM	21	17	4	100	100	100	100	100	100	100	100	100	100	100	100	99	99	99	98	96	92	72	35	10

This is a summarized report of the referenced procedures and does not include all reporting requirements. Additional data can be provided at client's request.

111 South Weber Drive, Suite1
Chandler, AZ 85226

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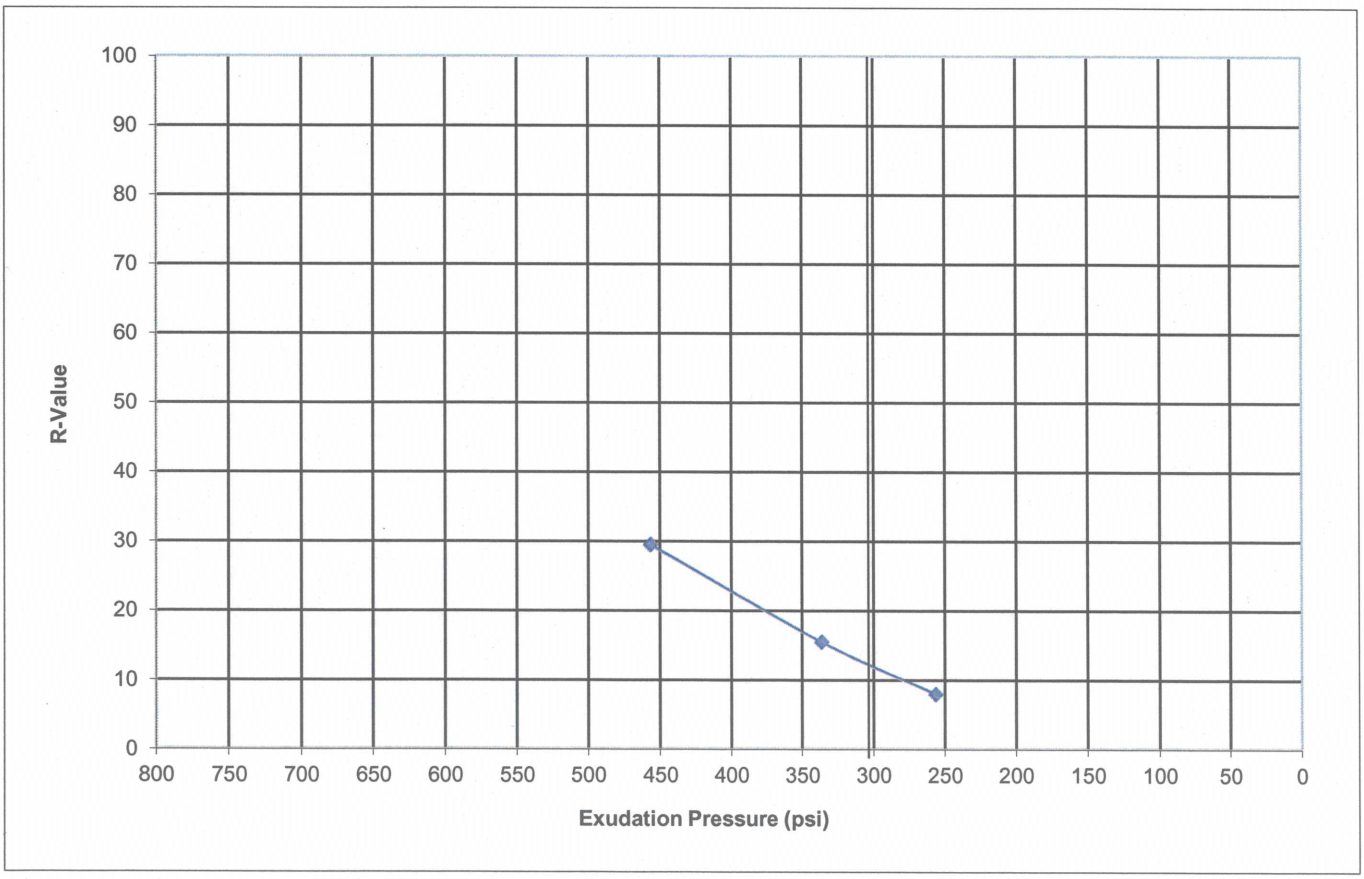
amec foster wheeler

PROJECT: Atek Project #170074 - Kayenta Bus Route
LOCATION: Glendale, AZ
MATERIAL: Native Soil
SAMPLE SOURCE: B-1 (0.5-3.0')

JOB NO: 19-2011-1087
WORK ORDER NO: 130
LAB NO: 17-2226
DATE SAMPLED: 05/11/17

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN ID	A	B	C
Moisture Content	14.6%	12.9%	12.0%
Compaction Pressure (psi)	50	200	275
Specimen Height (inches)	2.52	2.52	2.48
Dry Density (pcf)	116.6	121.6	123.0
Horiz. Pres. @ 1000lbs (psi)	58.0	47.0	38.0
Horiz. Pres. @ 2000lbs (psi)	138.0	121.0	95.0
Displacement	4.65	4.42	4.10
Expansion Pressure (psi)	0.3	1.8	3.1
Exudation Pressure (psi)	257	336	456
R Value	8	15	29



R Value at 300 PSI = 12

amec foster wheeler
3630 E Wier Ave.
Phoenix, AZ 85040

REVIEWED BY _____

APPENDIX E
Pavement Design

Flexible Pavement Design (AASHTO)

Project Name:	Kayenta Bue Route Phase 1
Project Number:	170074
Client:	Arrowhead Engineering, Inc
Location:	Kayenta, Arizona
Design Section:	Minor Collector - Option 1
Engineer:	J Floyd
Date:	6/1/2017

Flexible Pavement Structural Design:

Resilient Modulus (psi)	7,229
Subbase Type	AB
Subbase Thickness (inches)	8.0
Asphaltic Concrete Thickness (inches)	4.00
Cement Treated Subgrade (inches)	-
Required Structural Number	2.55
Section Structural Number	2.64
Performance (years)	20.0
Allowable 18-kip ESAL Repetition	219,000.0

Design Parameters:

Standard Normal Deviate	-1.037
Combined Standard error	0.35
Design Serviceability Loss	1.5
Desired Level of Reliability (percent)	85
Asphaltic Concrete Layer Coefficient	0.42
Subbase Layer Coefficient	0.12
Cement Treated Subgrade Layer Coefficient	0.18

Flexible Pavement Design (AASHTO)

Project Name:	Kayenta Bue Route Phase 1
Project Number:	170074
Client:	Arrowhead Engineering, Inc
Location:	Kayenta, Arizona
Design Section:	Minor Collector - Option 2
Engineer:	J Floyd
Date:	6/1/2017

Flexible Pavement Structural Design:

Resilient Modulus (psi)	7,229
Subbase Type	AB
Subbase Thickness (inches)	6.0
Asphaltic Concrete Thickness (inches)	5.00
Cement Treated Subgrade (inches)	-
Required Structural Number	2.55
Section Structural Number	2.70
Performance (years)	20.0
Allowable 18-kip ESAL Repetition	219,000.0

Design Parameters:

Standard Normal Deviate	-1.037
Combined Standard error	0.35
Design Serviceability Loss	1.5
Desired Level of Reliability (percent)	85
Asphaltic Concrete Layer Coefficient	0.42
Subbase Layer Coefficient	0.1
Cement Treated Subgrade Layer Coefficient	0.18

Flexible Pavement Design (AASHTO)

Project Name:	Kayenta Bue Route Phase 1
Project Number:	170074
Client:	Arrowhead Engineering, Inc
Location:	Kayenta, Arizona
Design Section:	Minor Collector - Option 3
Engineer:	J Floyd
Date:	6/1/2017

Flexible Pavement Structural Design:

Resilient Modulus (psi)	7,229
Subbase Type	AB
Subbase Thickness (inches)	4.0
Asphaltic Concrete Thickness (inches)	3.00
Cement Treated Subgrade (inches)	8.00
Required Structural Number	2.55
Section Structural Number	3.18
Performance (years)	20.0
Allowable 18-kip ESAL Repetition	219,000.0

Design Parameters:

Standard Normal Deviate	-1.037
Combined Standard error	0.35
Design Serviceability Loss	1.5
Desired Level of Reliability (percent)	85
Asphaltic Concrete Layer Coefficient	0.42
Subbase Layer Coefficient	0.12
Cement Treated Subgrade Layer Coefficient	0.18

Flexible Pavement Design (AASHTO)

Project Name:	Kayenta Bue Route Phase 1
Project Number:	170074
Client:	Arrowhead Engineering, Inc
Location:	Kayenta, Arizona
Design Section:	Major Collector - Option 1
Engineer:	J Floyd
Date:	6/1/2017

Flexible Pavement Structural Design:

Resilient Modulus (psi)	7,229
Subbase Type	AB
Subbase Thickness (inches)	7.0
Asphaltic Concrete Thickness (inches)	5.00
Cement Treated Subgrade (inches)	-
Required Structural Number	2.88
Section Structural Number	2.94
Performance (years)	20.0
Allowable 18-kip ESAL Repetition	438,000.0

Design Parameters:

Standard Normal Deviate	-1.037
Combined Standard error	0.35
Design Serviceability Loss	1.5
Desired Level of Reliability (percent)	85
Asphaltic Concrete Layer Coefficient	0.42
Subbase Layer Coefficient	0.12
Cement Treated Subgrade Layer Coefficient	0.18

Flexible Pavement Design (AASHTO)

Project Name:	Kayenta Bue Route Phase 1
Project Number:	170074
Client:	Arrowhead Engineering, Inc
Location:	Kayenta, Arizona
Design Section:	Major Collector - Option 2
Engineer:	J Floyd
Date:	6/1/2017

Flexible Pavement Structural Design:

Resilient Modulus (psi)	7,229
Subbase Type	AB
Subbase Thickness (inches)	6.0
Asphaltic Concrete Thickness (inches)	5.50
Cement Treated Subgrade (inches)	-
Required Structural Number	2.88
Section Structural Number	2.91
Performance (years)	20.0
Allowable 18-kip ESAL Repetition	438,000.0

Design Parameters:

Standard Normal Deviate	-1.037
Combined Standard error	0.35
Design Serviceability Loss	1.5
Desired Level of Reliability (percent)	85
Asphaltic Concrete Layer Coefficient	0.42
Subbase Layer Coefficient	0.1
Cement Treated Subgrade Layer Coefficient	0.18

Flexible Pavement Design (AASHTO)

Project Name:	Kayenta Bue Route Phase 1
Project Number:	170074
Client:	Arrowhead Engineering, Inc
Location:	Kayenta, Arizona
Design Section:	Major Collector - Option 3
Engineer:	J Floyd
Date:	6/1/2017

Flexible Pavement Structural Design:

Resilient Modulus (psi)	7,229
Subbase Type	AB
Subbase Thickness (inches)	4.0
Asphaltic Concrete Thickness (inches)	3.00
Cement Treated Subgrade (inches)	8.00
Required Structural Number	2.88
Section Structural Number	3.18
Performance (years)	20.0
Allowable 18-kip ESAL Repetition	438,000.0

Design Parameters:

Standard Normal Deviate	-1.037
Combined Standard error	0.35
Design Serviceability Loss	1.5
Desired Level of Reliability (percent)	85
Asphaltic Concrete Layer Coefficient	0.42
Subbase Layer Coefficient	0.12
Cement Treated Subgrade Layer Coefficient	0.18

APPENDIX B:

STORMWATER POLLUTION PREVENTION PLAN

Stormwater Pollution Prevention Plan (SWPPP)

For Construction Activities At:

0,67 East of intersection of
Navajo Route 6486 &
US Highway 163
Kayenta, AZ

SWPPP Prepared For:

Kayenta Township
100 N. Highway 163
PO Box 1490
Kayenta, AZ 86033

SWPPP Prepared By:

Arrowhead Engineering, Inc.
Merwin T. Yellowhair, P.E.
1685 S. San Todaro Pl.
Tucson, Arizona, 85713
Tel/Fax: 520-777-3438
Email: merwiny@arrowheadengineeringinc.com

SWPPP Preparation Date:

7 / 26 / 2017

Estimated Project Dates:

Project Start Date: 8 / 21 / 2017
Project Completion Date: 12 / 15 / 2017

SWPPP Content

Development, implementation, and maintenance of the SWPPP will provide the general contractor with the framework for reducing soil erosion and minimizing pollutants in storm water during excavation activities at Manned Range 1. The SWPPP:

- Defines the characteristics of the site and the type of construction which will be occurring;
- Describes the site plan for the development to be constructed and discuss the proposed construction sequences;
- Describes the practices that will be implemented to control erosion and the release of pollutants in storm water.
- Creates an implementation schedule to ensure that the practices described in this SWPPP are implemented and to evaluate the plan's effectiveness in reducing erosion, sediment, and pollutant levels in storm water discharged from the site; and
- Describes the final stabilization/termination design to minimize erosion and prevent storm water impacts after construction is complete.
- Identifies the SWPPPP coordinator's duties;
- Identifies the drainage areas and potential storm water contaminants;
- Describes the project's monitoring plan and how controls will be coordinated with construction activities; and
- Describes the implementation schedule and provision for amendment of the plan.

SWPPP Coordinator and Duties

- Implements the SWPPP plan;
- Oversees maintenance practices identified as BMPs in the SWPPP;
- Implements and oversees employee training;
- Conducts or provides for inspection and monitoring activities;
- Identifies other potential pollutant sources and make sure they are added to the plan;
- Identifies any deficiencies in the SWPPP and make sure they are added to the plan;
- Identifies any deficiencies in the SWPPP and make sure they are corrected; and
- Ensures that any changes in construction plans are addressed in the SWPPP.

In developing the proposed project certain measures will be implemented to minimize the impacts erosion and sedimentation could have on the surrounding resource areas. This SWPPP document addresses items that involve proper construction techniques, close surveillance of workmanship, and immediate response to emergency situations. The owner and contractor must be prepared to provide whatever reasonable measures are necessary to protect the environment during construction and to stabilize all disturbed areas as soon as construction ends.

Contents

SECTION 1: CONTACT INFORMATION/RESPONSIBLE PARTIES

1.1 Operator(s) / Subcontractor(s)

Operator(s):

Name:
Title:
Address:

Phone:
Email:

Subcontractor(s):

Name:
Title:
Address:

Phone:

Emergency 24-Hour Contact:

Name:
Title:
Mobile:

1.2 Stormwater Team

The Stormwater Team member(s) for this project are:

Name:
Title:
Address:
Phone:
Email:

Name:
Title:
Address:
Phone:
Email:

SECTION 2: SITE EVALUATION, ASSESSMENT, AND PLANNING

2.1 Project/Site Information

Project Name and Address

0,67 East of intersection of
Navajo Route 6486 &
US Highway 163
Kayenta, AZ

Project Latitude/Longitude

Latitude:
1. 36°43'28.8"N (degrees, minutes, seconds)

Longitude:
1. 110°15'22.6"W (degrees, minutes, seconds)

Method for determining latitude/longitude:
☐ USGS topographic map (specify scale:_____) ☐ EPA Web site ☐ GPS
☒ Other (please specify): Google Earth

Horizontal Reference Datum:
☐ NAD 27 ☒ NAD 83 or WGS 84 ☐ Unknown

Additional Project Information

Is the project/site located on Indian country lands, or located on a property of religious or cultural significance to an Indian tribe? ☒ Yes ☐ No **Located on Navajo Nation.**

Earth-disturbing activities are not being conducted in response to a public emergency.

Are you applying for permit coverage as a "federal operator" as defined in Appendix A of the 2012 CGP? ☐ Yes ☒No

The project is not applying for permit coverage as a "federal operator" as defined in Appendix A of the 2012 CGP.

2.2 Discharge Information

Does your project/site discharge stormwater into a Municipal Separate Storm Sewer System (MS4)? ☐ Yes ☒ No

Are there any surface waters that are located within 50 feet of your construction disturbances?
☒ Yes ☐No Laguna Creek Tributary

2.3 Nature of the Construction Activity

General Description of Project
The project site is located east of US Route 163 near the intersection of US Route 163 and Navajo Service Route 6486. The parcel is located in Sections 1 & 2, Township 38 North, and Range 19 East, G&SRB&M, Navajo County, Kayenta, Arizona.

The bus route is approximately 0.67 miles long and covers approximately 3.58 acres. The bus route comes off US Highway 163 and goes east past the Kayenta Chapter House property and past the N.A.T.I.V.E. campus. Along the north of the bus route is Monument Valley High School and along the south includes the Kayenta Headstart, Handicap Citizen Center and the N.A.T.I.V.E. campus.

The project development is proposed to regrade the existing bus route and provide pavement to the bus route. The bus route improvements paves to approximate 3,550 feet, starting at the existing asphalt limits south of the Kayenta Chapter House property to the project limit east of the N.A.T.I.V.E. campus turn out.

The new road will feature 5' sidewalks, curb and gutter, scuppers, 30' wide pavement. The new road is designed to be above the Q100 water surface elevation. The existing drainage currently drains through several existing culverts north into an area between MVHS berm and new bus route.

The General Contractor is responsible for soil disturbing activities that include:

1. Clearing and Grubbing.
2. Earthwork associated with road construction within the 100' ROW.
3. Placement of materials and compaction to design plan limits and elevations.
4. Placement of BMPs: filter socks and hay bales.
5. Installation of driveways for private residences. Some driveways will require fill and gravel outside of ROW to meet grades of new road.

This SWPPP will implement hay bales and utilize on-site biosocks to mitigate impact from excavation.

2.4 Sequence and Estimated Dates of Construction Activities

The mobilization date is slated for April 2017. Activities are anticipated to be complete prior to October 2017.

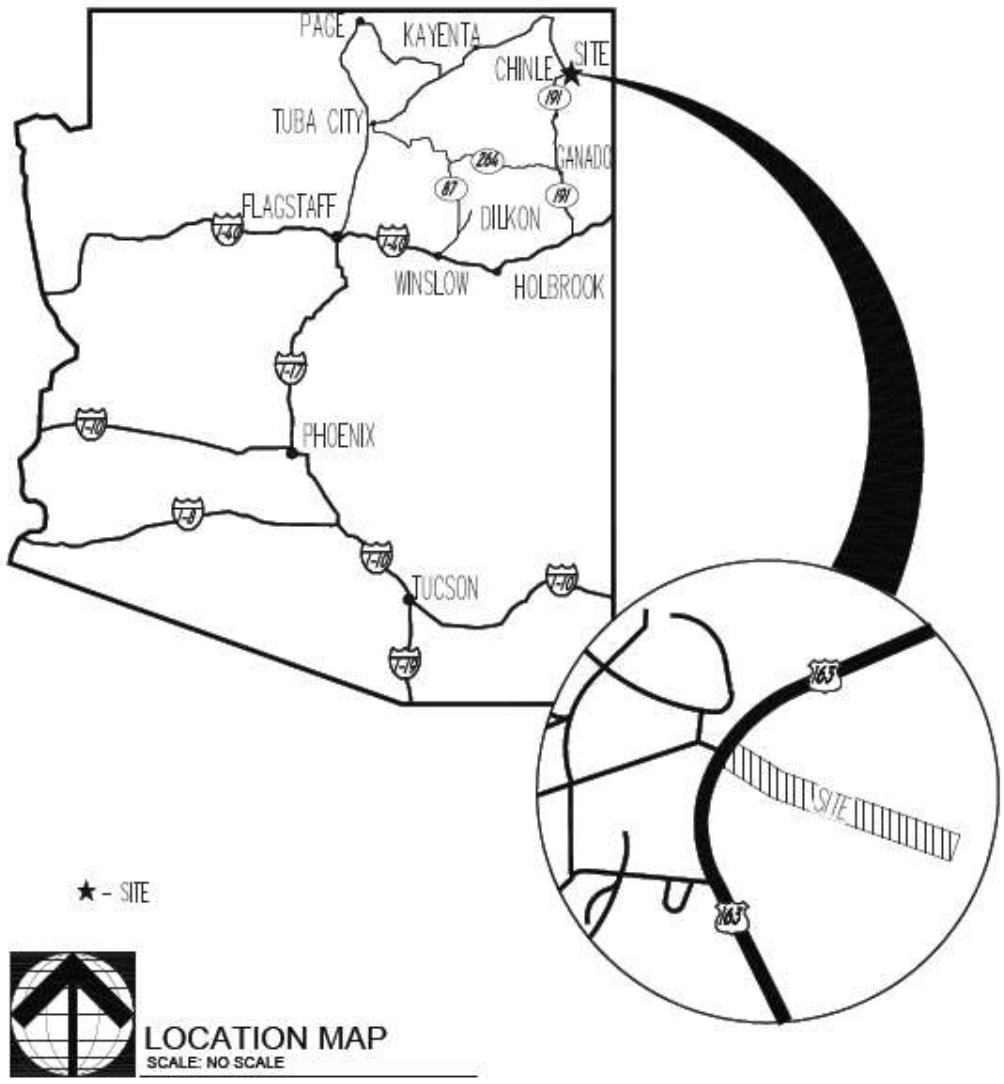
Estimated timeline of activity	**Construction activity and BMP description** (*Sequence is subject to change)
Aug. 2017	***Before any site grading activities begin:*** 1. Mobilize and install BMPs. 2. Install bio-sock & hay bales per detail, as indicated on SWPP Plan Sheets.
Aug. – Sep. 2017	***Site Trenching:*** *1. Begin Clearing & Grubbing.* 2. Rough Grading. Form curbs/sidewalks. 3. Form box culvert.
Oct.-Nov. 2017	***Archaeological Investigation:*** *1. Pour Box Culvert, curb, and walks.* *2. Final Grading.* *3. Install pavement.*
Mid-Dec. 2017	***Final Stabilization:*** *1. Remove all temporary control BMPs and stabilize any areas disturbed by their removal with equipment and hand shovel compaction.*

2.5 Allowable Non-Stormwater Discharges

List of Allowable Non-Stormwater Discharges Present at the Site

Type of Allowable Non-Stormwater Discharge	**Likely to be Present at Your Site?**
Discharges from emergency fire-fighting activities	☐ YES ☒ NO
Fire hydrant flushings	☐ YES ☒ NO
Landscape irrigation	☐ YES ☒ NO
Waters used to wash vehicles and equipment	☐ YES ☒ NO
Water used to control dust	☒ YES ☐ NO
Potable water including uncontaminated water line flushings	☐ YES ☒ NO
Routine external building wash down	☐ YES ☒ NO
Pavement wash waters	☐ YES ☒ NO
Uncontaminated air conditioning or compressor condensate	☐ YES ☒ NO
Uncontaminated, non-turbid discharges of ground water or spring water	☐ YES ☒ NO
Foundation or footing drains	☐ YES ☒ NO
Construction dewatering water	☐ YES ☒ NO

2.6 Site Maps



SECTION 3: DOCUMENTATION OF COMPLIANCE WITH OTHER FEDERAL REQUIREMENTS

3.1 Endangered Species Protection

Eligibility Criterion

Criteria A: No federally-listed threatened or endangered species or their designated critical habitat(s) are likely to occur in your site's "action area".

Supporting Documentation

Kayenta Township has not issued any reference documents but this is an existing project with existing road gravel and is previously approved with no objection to impacts on Environment of Wildlife.

- ☐ Specific communication with staff of the U.S. Fish & Wildlife Service or National Marine Fisheries Service.
- ☐ Publicly available species list.
- ☒ Other source: See above for description.

3.2 Historic Preservation

Step 1
The following stormwater controls are planned to be installed for the project.

- ☒ 9" Bio-Sock
- ☒ Hay Bale
- ☐ Pond
- ☐ Stormwater Conveyance Channel (e.g., ditch, trench, perimeter drain, swale, etc.)
- ☐ Culvert
- ☐ Other type of ground-disturbing stormwater control:

Step 2
If you answered yes in Step 1, have prior surveys or evaluations conducted on the site already determined that historic properties do not exist, or that prior disturbances at the site have precluded the existence of historic properties? ☒ YES ☐ NO

Step 3
If you answered no in Step 2, have you determined that your installation of subsurface earth-disturbing stormwater controls will have no effect on historic properties? ☒ YES ☐ NO

If yes, provide documentation of the basis for your determination.
The land withdrawal process the Kayenta Township underwent require an Environment Assessment. This EA serves as the basis for no impact to Environmental, Wildlife, and Historic properties from this project. Contact Kayenta Township: 928-697-8451.
This document identifies existing properties. AEI has obtained all Lidar, Map, and Survey locations that matches this report investigation Sites and Isolates. SWPPP BMPs will be specified for each location based on this map and data contained in the report.

3.3 Safe Drinking Water Act Underground Injection Control Requirements

The project will not be using any groundwater recharge/infiltration structures

SECTION 4: EROSION AND SEDIMENT CONTROLS

4.1 Natural Buffers or Equivalent Sediment Controls

Buffer Compliance Alternatives
Are there any surface waters within 50 feet of your project's earth disturbances? ☒ YES ☐ NO

4.2 Perimeter Controls

General

- Surfaces waters are ephemeral streams that are located to the north and east near the site. These streams convey significant drainage flow after significant precipitation events and run parallel with the road, except at the box culvert crossing. These streams eventually enter the Laguna Creek.

Specific Perimeter Controls

Perimeter Control Description

- Biosocks run parallel to the existing road at the ROW limits. There will be an uphill side and downhill side. The uphill is meant to protect against low level storm activity. While the downhill is meant to contain any excavation material that may become loose with low level storms.

Installation

- See SWPP Details.
- The activity is currently anticipated to last 6 months pending delivery of materials to site.

Maintenance Requirements
BMPs will be inspected weekly and immediately after storm events to ensure is intact.

4.3 Sediment Track-Out

General

- To minimize the track-out of sediment onto off-site streets, other paved areas, and sidewalks from vehicles exiting the construction site, construction vehicles will be restricted to exit the construction areas at one point, where proper sediment track-out control will be installed and maintained.
- Construction Entrance is located at existing end of pavement new Kayenta Chapter House.

Specific Track-Out Controls

Track-Out Control Description

8" gravel bed along with metal mud rack will be used at construction entrance.

Installation

- Install at mobilization. Remove prior to pavement placement.

Maintenance Requirements
- Kayenta Township will inspect track out.

4.4 Stockpiled Sediment or Soil

General
- There will be stock piles of materials and over excavation within ROW.
- All material storage areas will be reviewed and approved by Kayenta Township.

Specific Stockpile Controls

Stockpiled Sediment/Soil Control Description
- Roadway practices and roadway materials stored will be done within ROW. If offsite storage is required Kayenta Township will review and approve site selection.

Installation
- Individual biosocks will be placed at base if determined to be required.

Maintenance Requirements
- The filter socks will be inspected weekly for erosion and immediately after storm events. Areas on or around the berms that have eroded will be stabilized immediately with water.

4.5 Minimize Dust

General
- Dust from the construction will be kept to a minimum by employing dust prevention techniques.

Specific Dust Controls

Dust Control Description
- Dust from the site will be controlled by using a mobile pressure-type distributor truck to apply potable water to disturbed areas. The mobile unit will apply water at a rate of 300 gallons per acre and be minimized as necessary to prevent runoff and ponding. Average daily disturbance will be less than 1 acre and the anticipated water use will be 500-750 gallons per day.

Installation
- Dust control will be implemented as needed once site grading has been initiated and during windy conditions (forecasted or actual wind condition of 20 mph or greater) while site grading is occurring.

Maintenance Requirements
- At least one mobile unit will be available at all times to distribute potable water to control dust on the project area. Each mobile unit will be equipped with a positive shutoff valve to prevent over watering of the disturbed area.
- Contractor is responsible to contact NTUA for construction water.

4.6 Minimize the Disturbance of Steep Slopes

General

- There will not be any steep slopes as defined by CGP appendix A. The maximum slope on this site will be 5:1.

Specific Steep Slope Controls

- No steep slope controls are necessary for this project.

4.7 Topsoil

General

- As currently planned, the site will remain mostly undisturbed.
- No top soil controls are necessary for this project.

4.8 Soil Compaction

General

- There will not be any vegetative stabilization required for this project. The proposed site is relatively flat.

- No soil compaction controls are necessary for this project.

4.9 Storm Drain Inlets

- All stormwater runoff will remain as they exist today.

- No storm drain inlet controls are necessary for this project.

4.10 Constructed Stormwater Conveyance Channels

- There will not be any constructed stormwater conveyance channels required for this project.

4.11 Sediment Basins

- No Sediment basins are being proposed for this project. All site runoff will remain onsite.

4.12 Chemical Treatment

- No Chemical Treatment is being proposed for this project.

4.13 Dewatering Practices

- No dewatering practices are being proposed for this project.

4.14 Other Stormwater Controls

- In addition to the previously described controls, construction shall conform to all specifications as designated on the site plan, and in any other document or permits issued in association with this project.
- Wherever feasible, existing vegetation shall be retained and protected.
- All on-site drainage and adjacent roadway drainage shall be maintained in proper working condition during and after construction.

4.15 Site Stabilization

Site Stabilization Practice

- Biosock & haybale installation for the road.

SECTION 5: POLLUTION PREVENTION STANDARDS

5.1 Potential Sources of Pollution

Construction Site Pollutants

Potential sources of sediment to stormwater runoff:
- Clearing and grubbing operations
- Site excavation operations
- Vehicle tracking.

Potential pollutants and sources, other than sediment, to stormwater runoff:
- Combined Staging area – small fueling activities, minor equipment maintenance and sanitary facilities.
- Construction Activity – berms and trench excavation.

Pollutant-Generating Activity	**Pollutants or Pollutant Constituents** (that could be discharged if exposed to stormwater)	**Location on Site** (or reference SWPPP site map where this is shown)
Pesticides (insecticide, fungicides, herbicides, rodentcides)	Chlorinated hydrocarbons, organophoshates, carbamates, arsenic	None
Fertilizer	Nitrogen, phosphorus	None
Plaster	Calcium sulphate, calcium carbonate, sulfuric acid	None
Asphalt Pavement Operations	Oil, petroleum distillates	30' wide asphalt road.
Concrete Pavement Operations	Sediment, solvent, fuels	Concrete Box Culvert and driveways.
Concrete	Limestone, sand, pH, chromium	Sidewalk & Curbing.
Glue, adhesives	Polymers, epoxies	None

Pollutant-Generating Activity	**Pollutants or Pollutant Constituents** (that could be discharged if exposed to stormwater)	**Location on Site** (or reference SWPPP site map where this is shown)
Paint	Metal oxides, stoddard solvent, talc, calcium carbonate, arsenic	None
Curing compounds	Naphtha	None
Wood preservatives	Stoddard solvent, petroleum distillates, arsenic, copper, chromium	None
Hydraulic oil/fluids	Mineral oil	Leaks or broken hoses from equipment
Gasoline	Benzene, ethyl benzene, toluene, xylene, MTBE	Secondary containment/staging area
Diesel Fuel	Petroleum distillate, oil & grease, naphthalene, xylenes	Secondary containment/staging area

5.2 Spill Prevention and Response

The day-to-day Operator listed below will be responsible for detection and response of spills and leaks:

Company:
Contact:
Address:
Phone:

The following describes the spill contingency plan to be implemented to prevent and response to leaks, spills and other releases:

- Equipment necessary to quickly attend to inadvertent spills or leaks will be stored on-site in a secure but accessible location. Such equipment shall include safety goggles, chemically resistant gloves and overshoe boots, water and chemical fire extinguishers, sand and shovels, suitable absorbent materials, storage containers and first aid equipment.
- Spills and leaks will be treated properly according to material type, volume of spillage, and location of the spill. Mitigation will include preventing further spillage, containing the spilled material in a safe and environmentally sound manner, and remediating any damage done to the environment.
- For spills of < 5 gallons, proceed with source control and containment, and clean up with absorbent materials or other applicable means, unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.
- For spills of >5 gallons, immediately contact the **Arizona Division of Emergency Management at 1-800-411-2336,** and an approved emergency response contractor.

Provide information on the type of material spilled, the location of the spill, the quantity of the spill and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so directed.

- If there is a Reportable Quantity (RQ) release during the construction period, then the **National Response Center** will be notified immediately at **800-424-8802**; within 14 days a report will be submitted to the EPA regional office describing the release, the date and circumstances of the release, and the steps taken to prevent another release. This Storm Water Pollution Prevention Plan must be updated to reflect any such steps or actions taken.

  RQ for Oil: More than 1,000 US Gallons in a single discharge to navigable waters. More than 42 US Gallons of oil in each of two discharges to navigable waters. RQ for Gasoline & Fuel see: *EPA 40 CFR Ch.1 (7-1-11 Edition) 302.4 Designation of Hazardous substances Table 302.4 – List of Hazardous Substances and RQ.*

- After perimeter site erosion control measures are installed, but before any further site work occurs, provide a 55-gallon spill containment kit and maintain on site throughout the construction period.

Installation:

- The spill prevention and control procedures will be implemented once construction begins on-site. April 2017 is anticipated mobilization date.

Maintenance Requirements:

- All personnel will be instructed, during tailgate training sessions, regarding the correct procedures for spill prevention and control. Notices that state these practices will be posted in the office trailer and the individual who manages, day-to-day site operations will be responsible for seeing that these procedures are followed. Amend spill contingency plan as required.

5.3 Fueling and Maintenance of Equipment or Vehicles

General

- There will be roadway equipment typical to roadway construction.
- **Refer to section 5.2** for responsible party contact information and for spill contingency plan to be implemented.

Specific Pollution Prevention Practices

Description

- The work period for this project will not necessitate onsite maintenance to equipment. Should a breakdown require maintenance, all equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallet. Absorbent, spill-cleanup materials and spill kits will be available at the combined staging and materials storage area. Drip pans will be placed under all equipment receiving maintenance and vehicles and equipment parked overnight.

Installation

- No BMPs for vehicle maintenance are planned for this project.

Maintenance Requirements

No vehicle maintenance is planned.

5.4 Washing of Equipment and Vehicles

Vehicle washing is not planned for this project. Vehicle washing is not permitted.

Disposal of Construction Products, Materials, and Wastes

5.5.1 Building Products

General

- There are no building products anticipated for this project.

5.5.2 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

General

- Storage of pesticides, herbicides, insecticides, fertilizers and landscape materials will be kept to a minimum. These products will be stored or covered in a manner that will prevent rainwater from coming contact with harmful chemicals.

Specific Pollution Prevention Practices

Description

- Storage of pesticide, herbicides, insecticides, fertilizers and landscape materials shall be kept in sealed containers and covered adequately or stored indoors to prevent contact with precipitation.
- There are no pesticide, herbicide, insecticides, fertilizers and landscape materials anticipated.

5.5.3 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

General

- Diesel fuel, hydraulic fluid, other petroleum products, and other related chemicals will be adequately contained to protect against spills and leaks.

Specific Pollution Prevention Practices

Description

- Diesel fuel, hydraulic fluid, other petroleum products, and other related chemicals will be kept in appropriate sealed containers and will be covered from precipitation.
- Refer to section 5.2 "Spill Prevention and Response" in case of a spill or leak.

Installation

- Proper stage and covering of diesel fuel, oil, hydraulic fluid, other petroleum products, and other related chemicals will be ongoing throughout construction.

Maintenance Requirements

- Routinely inspect storage locations and repair containers as necessary.

5.5.4 Hazardous or Toxic Waste

General

- Hazardous or toxic waste shall be stored in accordance with all local, state, and federal regulations to prevent spills and pollution from runoff.

Specific Pollution Prevention Practices

Description

- All hazardous and toxic waste shall be kept in appropriate sealed containers and will be covered from precipitation. Hazardous and toxic wastes shall be stored in accordance with all local, state, and federal regulations.
- Refer to section 5.2 "Spill Prevention and Response" in case of a spill or leak.

Installation

- Proper storage of all hazardous and toxic waste in appropriate sealed containers will be ongoing throughout construction.

Maintenance Requirements

- Routinely inspect storage location and repair containers as necessary.

5.5.5 Construction and Domestic Waste

General

- There is no waste anticipated. Any waste generated will be taken to Kayenta Transfer Station.

5.5.6 Sanitary Waste

General

- If Portable toilets will be provided for sanitary waste they will be located near the access road.

Specific Pollution Prevention Practices

Description

- Provide portable toilets of sufficient size and number for sanitary waste of construction personnel.

Installation

- Install portable containers at the start of construction.
- April 2017 is anticipated start date.
- The estimated start and end dates of construction disturbances associated with this phase has not been finalized. This SWPPP will be modified as soon as this information is available.
- Relocate portable containers as necessary as construction progresses.

Maintenance Requirements

- Inspect portable toilets routinely and service/empty as necessary in accordance with all local, state, and federal regulations.

5.6 Washing of Applicators and Containers used for Paint, Concrete or Other Materials

General

- General Contractor will maintain adequate concrete wash out containers. Kayenta Township will inspect concrete wash out and determine when additional or cleaning of wash outs are necessary.

5.7 Fertilizers

General

- No fertilizers are used for this project.

5.8 Other Pollution Prevention Practices

General

- If any pollution prevention practices that do not fit into the above categories are planned to be implemented, this SWPPP will be modified to include such information.

SECTION 6: INSPECTION AND CORRECTIVE ACTION

6.1 Inspection Personnel and Procedures

Personnel Responsible for Inspections

The day-to-day Operator or their trained representative will perform the inspections of the erosion and sediment controls. This applies to all inspections noted within this SWPPP:

Kayenta Township:
Name:
Title:
Phone:
Email:

The day-to-day Operator may delegate authority to oversee compliance with CGP and this SWPPP by completing the Delegation of Authority Form in Appendix J.

General

Inspections and inspection reports shall be performed in accordance with Part 4 of the CGP.

Inspection Schedule

Specific Inspection Frequency
Inspect erosion and sediment controls and all other pollution prevention measures once every 7 days, or every 14 days and within 24 hours of a ¼" storm event.

Rain Gauge Location (if applicable)
There will be no rain gauge necessary.

Inspection Report Forms
Refer to Appendix D for a copy of the Inspection Report Form

6.2 Corrective Action

Personnel Responsible for Corrective Actions
The day-to-day Operator will be responsible for corrective actions to the erosion and sediment controls.

General Contractor:
Name:
Mobile:
Address:

Refer to Section 5 of the attached 2017 CGP for requirements for taking corrective action, reporting and record keeping. This SWPPP will be modified within 7 calendar days to reflect any modifications to the pollution prevention measures required as a result of inspections.

Corrective Action Forms
Refer to Appendix E for a copy of the Corrective Action Form.

6.3 Delegation of Authority

Duly Authorized Representative(s) or Position(s):

General Contractor:
Name:
Mobile:
Address:

SECTION 7: TRAINING

- The Operator shall provide training for personnel who are responsible for the design, installation, maintenance, and/or repair of stormwater controls including pollution prevention measures); personnel responsible for the application and storage of treatment chemicals (if applicable); personnel who are responsible for conducting inspections as required in Part 4.1.; and personnel who are responsible for taking corrective actions as required in Part 5.

- The personnel shall be trained to understand the location of all stormwater controls on the site required by this permit, and how they are to be maintained; The proper procedures to follow with respect to the permit's pollution prevention requirements; and when and how to contact inspections, record applicable findings, and take corrective actions.

Table 7-1: Documentation for Completion of Training

Name	Date Training Completed

SECTION 8: CERTIFICATION AND NOTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____ Title: _____

Signature: _____ Date: _____

[Repeat as needed for multiple construction operators at the site.]

SECTION 9: General Compliance

COMPLIANCE WITH FEDERAL, STATE & LOCAL REGULATIONS

The project will comply with all applicable Federal, State and Local regulations and Section 404 and 401 of the Federal Clean Water Act.

SWPPP APPENDICES

Appendix A – SWPP Plans Site

Appendix B – 2012 CGP

Appendix C – NOI and EPA Authorization Email

Appendix D – Inspection Form

Appendix E – Corrective Action Form

Appendix F – SWPPP Amendment Log

Appendix G – Subcontractor Certifications/Agreements

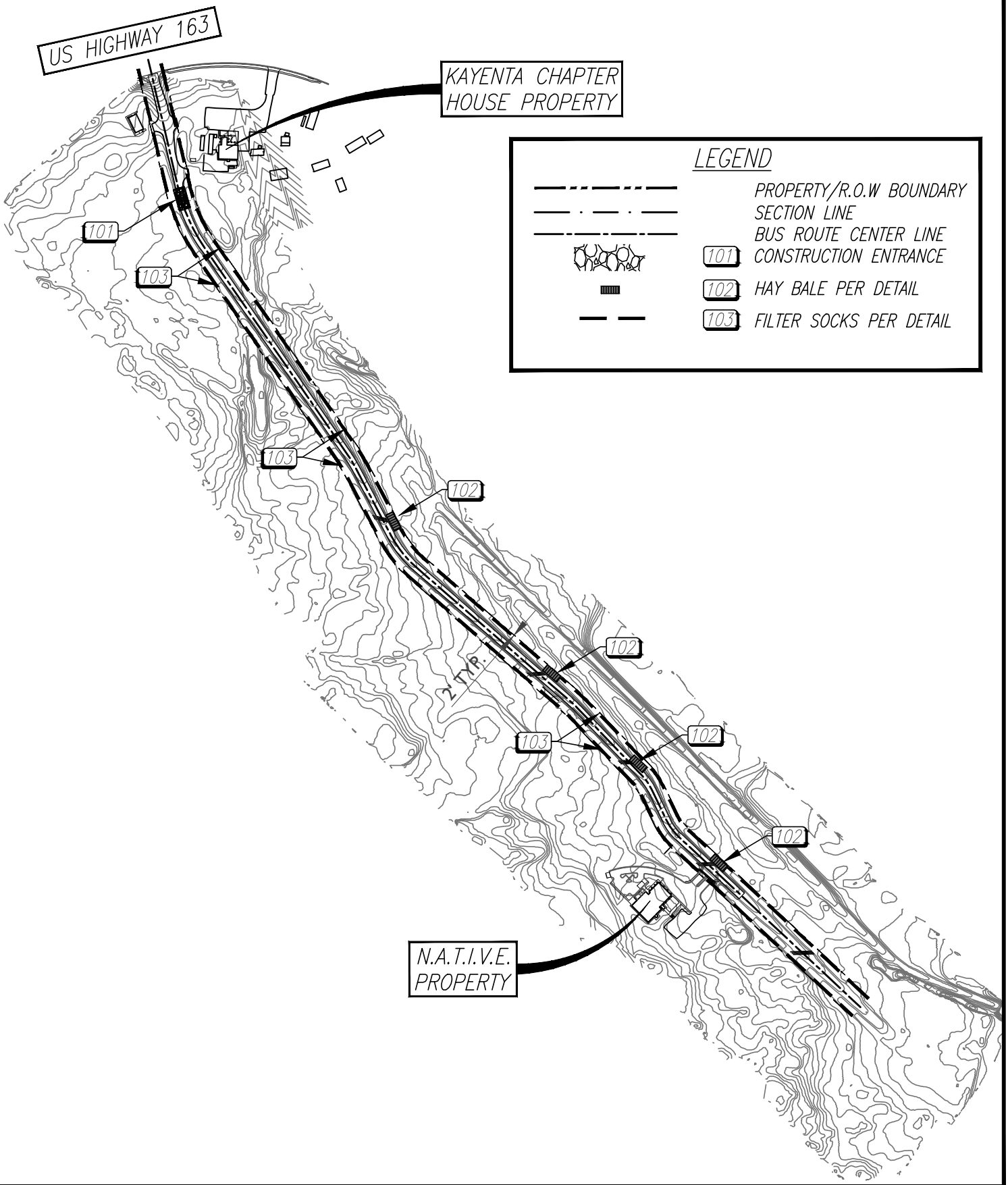
Appendix H – Grading and Stabilization Activities Log

Appendix I – Training Log

Appendix J – Delegation of Authority

Appendix A – Site Map & Details

SWPPP Site Plan for Kayenta Bus Route

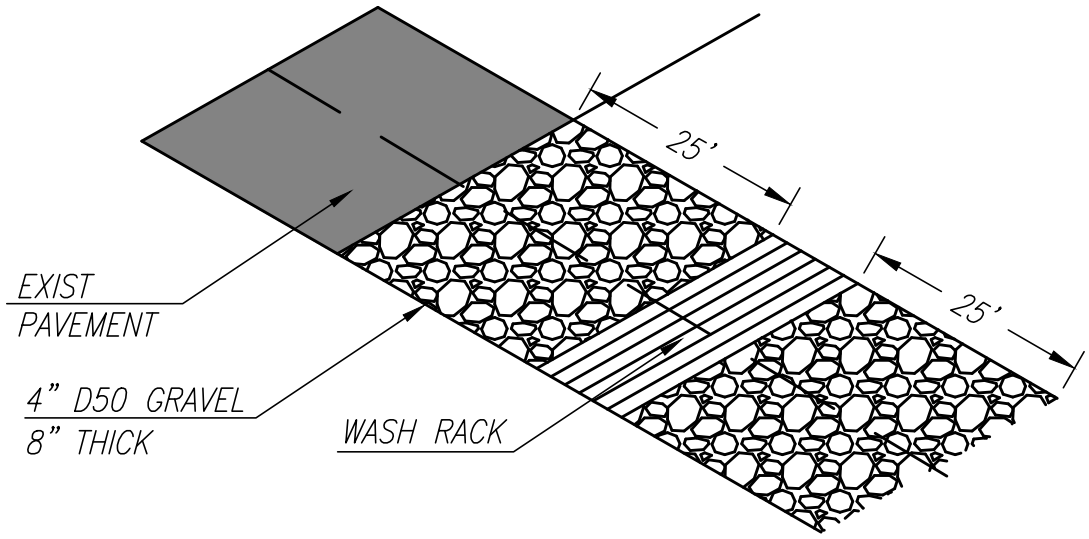


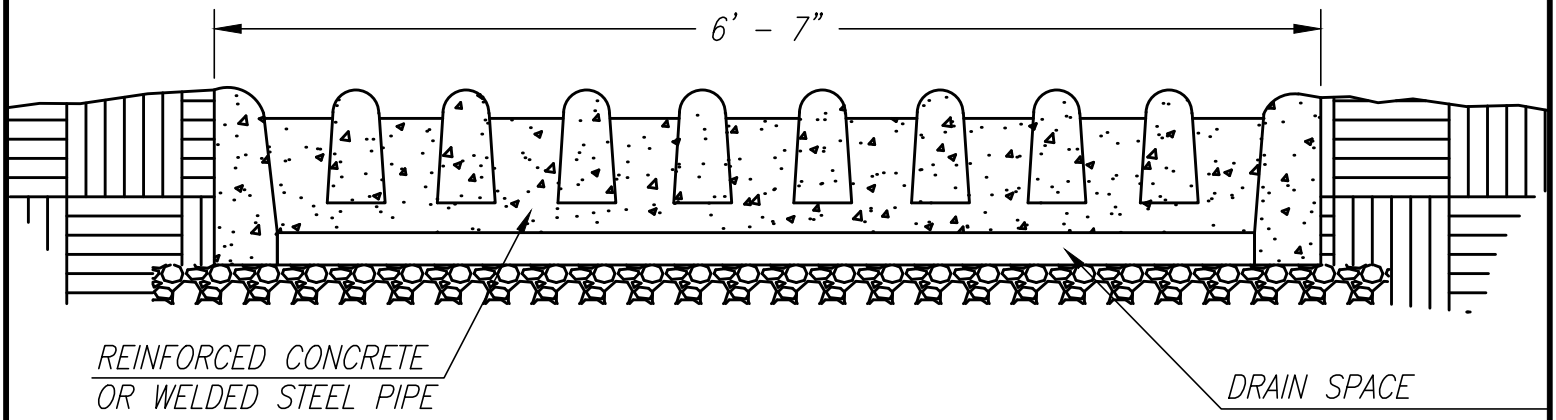
ARROWHEAD
ENGINEERING, INC.

1685 S. SAN TODARO PLACE
TUCSON, ARIZONA 85713
PHONE: 520-822-7702
FAX: 520-777-3438

PROJECT NO.:	217-003
DATE:	7-26-2017
DESIGNED BY:	MTY
DRAWN BY:	EQ
APPROVED BY:	-
OWNER:	KAYENTA

PROJECT: KAYENTA BUS ROUTE
LOCATION: KAYENTA, ARIZONA
TITLE: SWPPP SHT SW1
SCALE: 1" = 500'





CONSTRUCTION ENTRANCE DETAIL

NOT TO SCALE

101
SW1

ARROWHEAD
ENGINEERING, INC.

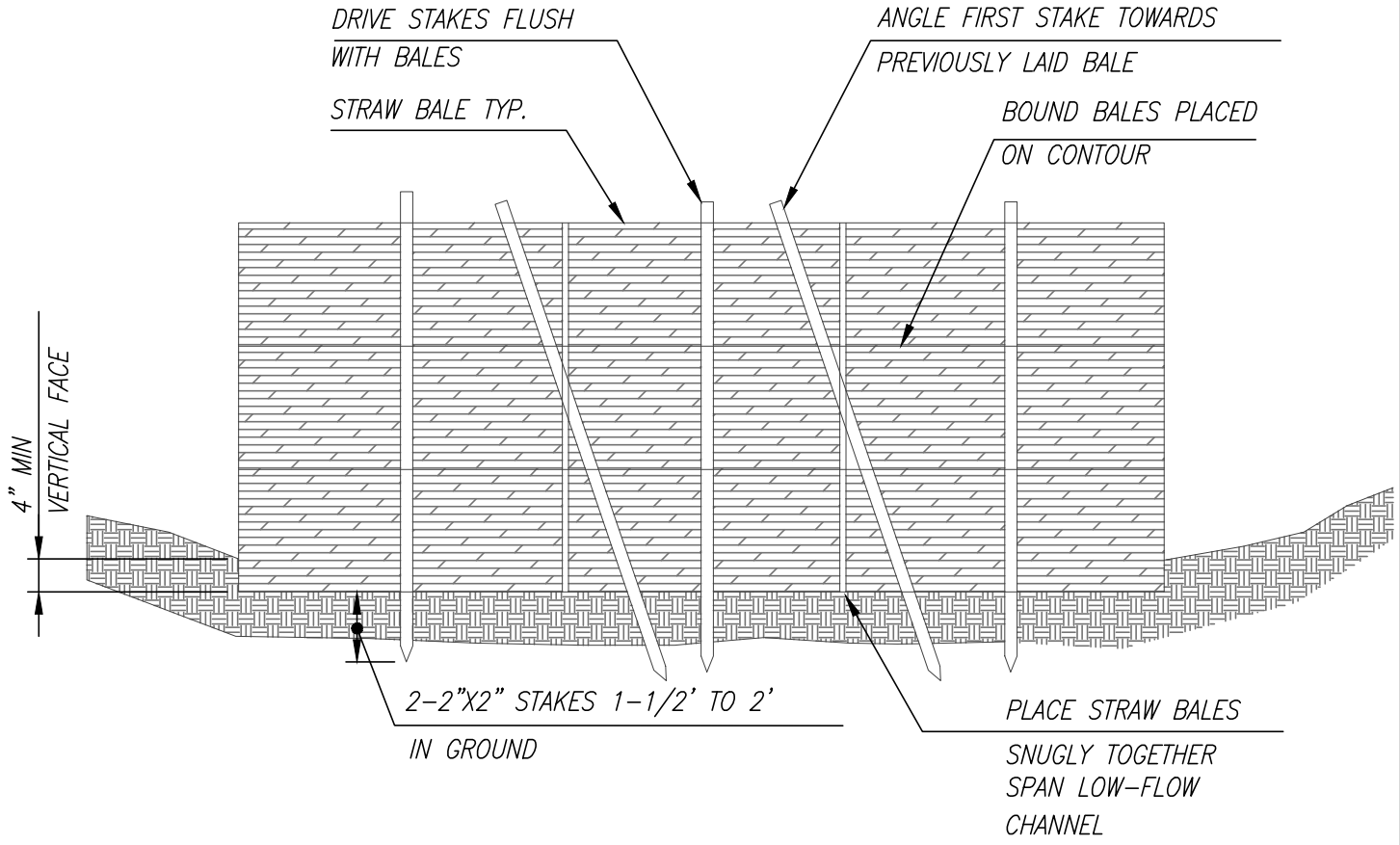
1685 S. SAN TODARO PLACE
TUCSON, ARIZONA 85713
PHONE: 520-822-7702
FAX: 520-777-3438

PROJECT NO.:	217-003
DATE:	7-26-2017
DESIGNED BY:	MTY
DRAWN BY:	EQ
APPROVED BY:	-
OWNER:	KAYENTA

PROJECT: KAYENTA BUS ROUTE
LOCATION: KAYENTA, ARIZONA
TITLE: SWPP CONSTRUCTION ENTRANCE
SCALE: NOT TO SCALE

STRAW BALE SEDIMENT TRAP DETAIL

1. STRAW BALES SHALL BE OF UNIFORM SHAPE AND SIZE AND SHALL BE FREE OF ANY INORGANIC MATTER.
2. LINE OF BALES MAY MEANDER TO AVOID DISTURBANCE OF EXISTING VEGETATION.
3. SUBSEQUENT TO ANY SUBSTANTIAL RAINFALL, THE CONTRACTOR SHALL INSPECT ALL STRAW BALE SEDIMENT TRAPS (DIKES) FOR DAMAGE.
4. ANY ROTTED OR BROKEN BALES SHALL BE REPLACED IMMEDIATELY UPON INSPECTION.
5. SUBSTITUTION OF STEEL BARS FOR WOODEN STAKES IS NOT RECOMMENDED DUE TO POTENTIAL FOR DAMAGING CONSTRUCTION EQUIPMENT.
6. IF USED IN A CHANNEL OR SWALE, STRAW BALES MUST LINE ENTIRE WIDTH OF CHANNEL.



STRAW BALE SEDIMENT TRAP DETAIL

NOT TO SCALE

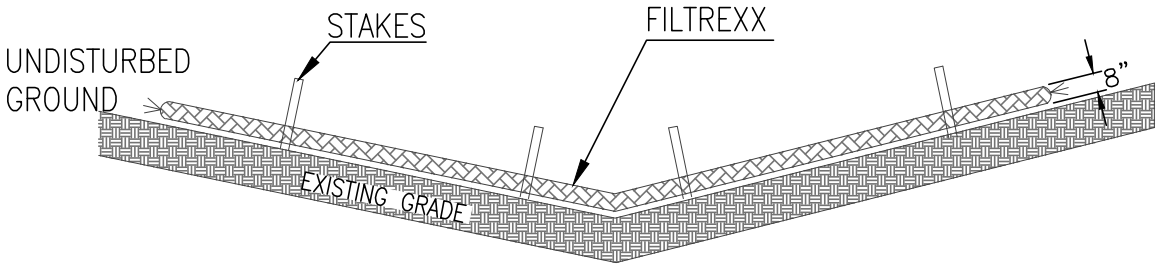
102
SW1

ARROWHEAD
ENGINEERING, INC.

1685 S. SAN TODARO PLACE
TUCSON, ARIZONA 85713
PHONE: 520-822-7702
FAX: 520-777-3438

PROJECT NO.:	217-003
DATE:	7-26-2017
DESIGNED BY:	MTY
DRAWN BY:	EQ
APPROVED BY:	-
OWNER:	KAYENTA

PROJECT: KAYENTA BUS ROUTE
LOCATION: KAYENTA, ARIZONA
TITLE: HAY BALE BMP
SCALE: NOT TO SCALE



SINGLE FILTREXX FILTER SOCK DETAIL

NOT TO SCALE

103
SW1

ARROWHEAD
ENGINEERING, INC.

1685 S. SAN TODARO PLACE
TUCSON, ARIZONA 85713
PHONE: 520-822-7702
FAX: 520-777-3438

PROJECT NO.:	217-003
DATE:	7-26-2017
DESIGNED BY:	MTY
DRAWN BY:	EQ
APPROVED BY:	-
OWNER:	KAYENTA

PROJECT: KAYENTA BUS ROUTE
LOCATION: KAYENTA, ARIZONA
TITLE: FILTER SOCK BMP
SCALE: NOT TO SCALE

Appendix B – 2012 CGP

2012 CGP can be found at link below:

https://www.epa.gov/npdes/epas-2012-construction-general-permit-cgp-and-related-documents

Appendix C – Copy of NOI and EPA Authorization email

Appendix D – Copy of Inspection Form

Stormwater Construction Site Inspection Report

General Information			
Project Name			
NPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications Insert qualifications or add reference to the SWPPP. (See Section 5 of the SWPPP Template)			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	
11		❑Yes ❑No	❑Yes ❑No	
12		❑Yes ❑No	❑Yes ❑No	
13		❑Yes ❑No	❑Yes ❑No	
14		❑Yes ❑No	❑Yes ❑No	
15		❑Yes ❑No	❑Yes ❑No	
16		❑Yes ❑No	❑Yes ❑No	
17		❑Yes ❑No	❑Yes ❑No	
18		❑Yes ❑No	❑Yes ❑No	
19		❑Yes ❑No	❑Yes ❑No	
20		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
	placed in covered dumpsters?			
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature:_____ Date:_____

Appendix E – Copy of Corrective Action Form

Corrective Action Report

General Information			
Project Name			
NPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			

Corrective Action Items:

Date Identified	BMP/Activity	Date Completed	Solution

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature:_____ Date:_____

Appendix F –SWPPP Amendment Log

Instructions (see CGP Part 7.4):

- Create a log here of changes and updates to the SWPPP. You may use the table below to track these modifications.
- SWPPP modifications are required pursuant to CGP Part 7.4.1 in the following circumstances:
  - ✓ Whenever new operators become active in construction activities on your site, or you make changes to your construction plans, stormwater control measures, pollution prevention measures, or other activities at your site that are no longer accurately reflected in your SWPPP;
  - ✓ To reflect areas on your site map where operational control has been transferred (and the date of transfer) since initiating permit coverage;
  - ✓ If inspections or investigations determine that SWPPP modifications are necessary for compliance with this permit;
  - ✓ Where EPA determines it is necessary to impose additional requirements on your discharge; and
  - ✓ To reflect any revisions to applicable federal, state, tribal, or local requirements that affect the stormwater control measures implemented at the site.
- If applicable, if a change in chemical treatment systems or chemically-enhanced stormwater control is made, including use of a different treatment chemical, different dosage rate, or different area of application.

No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]

Appendix G –Subcontractor Certifications/Agreements

SUBCONTRACTOR CERTIFICATION
STORMWATER POLLUTION PREVENTION PLAN

Project Number: _____

Project Title: _____

Operator(s): _____

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the practices described in the SWPPP.

This certification is hereby signed in reference to the above named project:

Company: _____

Address: _____

Telephone Number: _____

Type of construction service to be provided: _____
_____

Signature: _____

Title: _____

Date: _____

Appendix H – Grading and Stabilization Activities Log

Date Grading Activity Initiated	**Description of Grading Activity**	**Description of Stabilization Measure and Location**	**Date Grading Activity Ceased** (Indicate Temporary or Permanent)	**Date When Stabilization Measures Initiated**

Appendix I –SWPPP Training Log

Stormwater Pollution Prevention Training Log

Project Name:

Project Location:

Instructor's Name(s):

Instructor's Title(s):

Course Location: _____ Date: _____

Course Length (hours): _____

Stormwater Training Topic: *(check as appropriate)*

- ❑ **Sediment and Erosion Controls**
- ❑ **Emergency Procedures**
- ❑ **Stabilization Controls**
- ❑ **Inspections/Corrective Actions**
- ❑ **Pollution Prevention Measures**

Specific Training Objective:_____

_____

Attendee Roster: *(attach additional pages as necessary)*

No.	Name of Attendee	Company
1		
2		
3		
4		
5		
6		
7		
8		

Appendix J – Delegation of Authority Form

Delegation of Authority

I, Chas (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit, at the Gila Bend Air Force Auxiliary Field, BMGR East construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

Merwin Yellowhair, PE (name of person or position)
Arrowhead Engineering, Inc. (company)
1 S. Church Avenue 12th Floor (address)
Tucson, Arizona 85701 (city, state, zip)
520-822-7702 (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in Appendix I of EPA's Construction General Permit (CGP), and that the designee above meets the definition of a "duly authorized representative" as set forth in Appendix I.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____

Company: _____

Title: _____

Signature: _____

Date: _____

Appendix K – Endangered Species Documentation

INSERT DOCUMENTATION CONSISTENT WITH SWPPP TEMPLATE SECTION 3.1

Appendix L – Historic Properties Documentation

INSERT DOCUMENTATION CONSISTENT WITH SWPPP TEMPLATE SECTION 3.2