

**CITY AND COUNTY OF DENVER  
DEPARTMENT OF PUBLIC WORKS**

<b>CONTRACT NO: 201952435 PROJECT NAME: MARION STREET SYSTEM, PHASE 1</b>
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**ADDENDUM NO. 3 TO CONTRACT DOCUMENTS  
ISSUED FEBRUARY 13, 2020**

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented and/or superseded for the above-mentioned project as hereinafter described in the following attachments:

**TECHNICAL SPECIFICATIONS/DRAWINGS REVISIONS AND CHANGES:**

- 1. WCPM Standard Construction Specification (Attachment A)**
  - **Remove Section 02-221301 – Vibration Monitoring, Public Outreach and Pre-Construction Facility Condition Assessment (Page 02-221301-1 through 02-221301-12) and replace with revised Section 02-221301 – Vibration Monitoring, Public Outreach and Pre-Construction Facility Condition Assessment (Page 02-221301-1 through 02-221301-12)**

Each change in the above listed attachment is denoted with a cloud. Each revised project specifications page shall remove and replace its corresponding page, as the project specifications page numbers remain the same.

**BID DOCUMENTS:**

- 1. Please note the addition of four Special Contract Conditions (SC-18 to SC-21) to this contract. The Bid Document Package is modified by the addition of the following Special Contract Condition terms:**

**SC-18 DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE (Replaces General Contract Condition 203)**

As of January 1, 2020, the functions of Public Works are housed in the new Department of Transportation and Infrastructure. For purposes of this Contract all references (including, but not limited to, references appearing in the body of the contract, General Conditions, Special Conditions, Exhibits, Contract Documents or Policies and Procedures) to the Department of Public Works will have the same meaning as the Department of Transportation and Infrastructure.

Vested exclusively in the Department of Transportation and Infrastructure is the management and control of the design and construction of general and local public improvements undertaken by the City and County of Denver, except for: (i) work which is under the management and control of the Department of Aviation; (ii) that work performed by the Denver Board of Water Commissioners; (iii) any such work that the Mayor has specifically assigned to another department or agency; and (iv) work under the authority of the Department of Transportation and Infrastructure that is performed with the permission of the Manager of Transportation and Infrastructure by private entities at their own expense.

**SC-19 MANAGER OF DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE (Replaces General Contract Condition 204)**

General Condition 204 "Manager of Public Works" is hereby deleted in its entirety and replaced with the following:

As of January 1, 2020, the functions of Public Works are housed in the new Department of Transportation and Infrastructure. The Manager of Public Works / Executive Director of Public Works will become the Executive Director of Transportation and Infrastructure. Manager of Public Works, Executive Director of Public Works, Executive Director of Transportation and Infrastructure and Manager of Transportation and Infrastructure will have the same meaning for purposes of this Agreement.

#### **SC-20 ACCOUNTING OF COST AND AUDIT**

Title 911 is hereby deleted in its entirety and replaced with the following:

Any authorized agent of the City, including the City Auditor or his or her representative, has the right to access, and the right to examine, copy and retain copies, at City's election in paper or electronic form, any pertinent books, documents, papers and records related to Contractors' performance pursuant to this Agreement, provision of any goods or services to the City, and any other transactions related to this Agreement. Contractor shall cooperate with City representatives and City representatives shall be granted access to the foregoing documents and information during reasonable business hours and until the latter of three (3) years after the final payment under the Agreement or expiration of the applicable statute of limitations. When conducting an audit of this Agreement, the City Auditor shall be subject to government auditing standards issued by the United States Government Accountability Office by the Comptroller General of the United States, including with respect to disclosure of information acquired during the course of an audit. No examination of records and audits pursuant to this paragraph shall require Contractor to make disclosures in violation of state or federal privacy laws. Contractor shall at all times comply with D.R.M.C. 20-276.

#### **SC-21 DEFENSE AND INDEMNIFICATION**

Title 1602 is hereby deleted in its entirety and replaced with the following:

- (a) To the fullest extent permitted by law, the Contractor hereby agrees to defend, indemnify, reimburse and hold harmless City, its appointed and elected officials, agents and employees for, from and against all liabilities, claims, judgments, suits or demands for damages to persons or property arising out of, resulting from, or related to the work performed under this Agreement that are due to the negligence or fault of the Contractor or the Contractor's agents, representatives, subcontractors, or suppliers ("Claims"). This indemnity shall be interpreted in the broadest possible manner consistent with the applicable law to indemnify the City.
- (b) Contractor's duty to defend and indemnify City shall arise at the time written notice of the Claim is first provided to City regardless of whether suit has been filed and even if Contractor is not named as a Defendant.
- (c) Contractor will defend any and all Claims which may be brought or threatened against City and will pay on behalf of City any expenses incurred by reason of such Claims including, but not limited to, court costs and attorney fees incurred in defending and investigating such Claims or seeking to enforce this indemnity obligation. Such payments on behalf of City shall be in addition to any other legal remedies available to City and shall not be considered City's exclusive remedy.
- (d) Insurance coverage requirements specified in this Agreement shall in no way lessen or limit the liability of the Contractor under the terms of this indemnification obligation. The Contractor shall obtain, at its own expense, any additional insurance that it deems necessary for the City's protection.
- (e) This defense and indemnification obligation shall survive the expiration or termination of this Agreement.

#### **QUESTIONS AND ANSWERS:**

Q1. Does the Public Vibration Information Liaison need to accompany the Facility Condition Assessment Expert on the Pre-Construction Facility Condition Assessment?

**A1. No. The Public Vibration Information Liaison (PVIL) does not need to attend the Pre-Construction Facility Condition Assessment. The PVIL is responsible for the phased outreach attempts with**

property owners/occupants to gain permission to enter private property as outlined in Specification Section 02-221301/3.1/B (issued in Addendum #2). The only person required to attend the Pre-Construction Facility Condition Assessment is the Facility Condition Assessment Expert.

- Q2. Can you clarify the boundaries the Public Vibration Information Liaison will need to cover for the distribution of the City of Denver provided Vibration Pamphlet?
- A2. **The vibration pamphlet needs to be distributed to every address within the Mandatory Communication Outreach Area. This is a 500' radius from all work locations associated with the Marion Street System, Phase 1 project. Please note that this outreach area extends 500' North of STA 53+50 (Plan Sheet STM-01) and 500' south of the end of the work (Base Bid – STA 75+40 (Plan Sheet STM-04), Add Alt 1 – STA 79+95 (Plan Sheet STM-04) or Add Alt 2 – STA 84+00 (Plan Sheet STM-05)).**
- Q3. Can you clarify the boundaries the Public Vibration Information Liaison will need to cover for the phased outreach plan to establish right of entry for the Pre-Construction Facility Condition Assessments to be performed?
- A3. **The minimum area for the Pre-Construction Facility Condition Assessment to be performed is a 250' radius from all work locations associated with the Marion Street System, Phase 1 project. The addresses within this 250' radius was included for the bidders use on Plan Sheet PFCA-01 as distributed in Addendum #2. Please note that this outreach area extends 250' North of STA 53+50 (Plan Sheet STM-01) and 250' south of the end of the work (Base Bid – STA 75+40 (Plan Sheet STM-04), Add Alt 1 – STA 79+95 (Plan Sheet STM-04) or Add Alt 2 – STA 84+00 (Plan Sheet STM-05)).**

**Should the winning Contractor's Vibration Monitoring Expert determine that the Zone of Influence will need to extend beyond a 250' radius, the boundary of the phased outreach (see Specification Section 02-221301/3.1/B for further information on phased outreach plan) and the Pre-Construction Facility Condition Assessments will increase to the external limits of the Zone of Influence as defined by the contractors Vibration Monitoring Expert.**

- Q4. Do all the Pre-Construction Facility Assessments for the entire project need to be completed prior to the contractor being allowed to begin active construction activities?
- A4. **No. For example, if the contractor were to begin active construction activities at STA 53+50, the assessments will need to have been performed and submitted for a 250' radius (or greater if determined by the Contractor's Vibration Monitoring Expert) from that specific point. For construction activities to progress to STA 53+60, assessments will need to have been performed and submitted for a 250' radius from that specific point, so on and so forth as work progresses. Should the Contractor's Vibration Monitoring Expert determine that the Zone of Influence will need to be greater than the 250' radius minimum, assessments will need to be performed to these extents prior to starting construction activities.**

**The Zone of Influence of the Contractor's construction activities should never encroach on a structure that has not had a reasonable opportunity to have an assessment performed (as outlined in the phased outreach approach in Specification Section 02-221301/3.1/B). Should the Contractor's Zone of**

**Influence of active construction activities catch up to their performance of Pre-Construction Facility Condition Assessments, construction activities will need to be suspended until assessments can catch up. The contractor will not be compensated for any down time costs caused by this lack of coordination of their efforts.**

Q5. Specification Section 02-221301/3.3/G states that “vibration monitoring shall be continuous 24 hours a day/ 7 days a week. From the time of mobilization until demobilization.” Is this an accurate expectation of the City of Denver?

**A5. 24 hour a day, 7 day a week vibration monitoring will not be required for this project. Specification Section 02-221301/3.3/G has been revised and the specification section is reissued in Addendum #3.**

Q6. Does the Vibration Monitoring Expert identified in Specification 02-221301 need to be on site full time?

**A6. No, the VME is not expected or required to be on site full time during construction activities. As outlined in Specification 02-221301, the VME’s responsibilities during construction include: submitting Vibration Raw Data, Vibration Weekly Reports and Contingency Plan Implementation Reports; provide vibration instrumentation and monitoring; consult with contractor on placement, movement and quantity of monitoring instrumentation as work progresses; consult with contractor and City Construction Project Manager should threshold or shutdown values be exceeded. Please refer to Specification 02-221301 for a full comprehensive list of requirements for the VME.**

Q7. Does the Facility Condition Assessment Expert identified in Specification 02-221301 need to be a structural engineer?

**A7. No, the FCAE does not need to be a structural engineer. Please refer to Specification Section 02-221301/1.3/C for FCAE minimum qualifications.**

Q8. Are the base bid contract terms of performance going to be extended beyond 240 days due to the up-front requirements of Specification 02-221301?

**A8. Yes. The terms of performance for this project has been increased to 270 days, per Addendum #3.**

Q9. Will City of Denver be able to supply property owner contact information to the successful bidder to assist in the Public Vibration Information Liaison’s efforts?

**A9. Yes. The City Construction Project Manager will assist the contractor/PVIL in providing a comprehensive list of property owner contact information (as available through the City Assessor’s website) for both the Mandatory Communication Outreach Area and the required phased outreach area for attempting to gain access to perform Pre-Construction Facility Condition Assessments.**

Q10. Will the Facility Condition Assessment Expert be required to perform Pre-Construction Facility Condition Assessments during non-traditional working hours?

**A10. It should be anticipated when granted permission to perform a Pre-Construction Facility Condition Assessment on private property, that a certain percentage of property owners/occupants will need to have the assessment performed during non-traditional working hours (including weekends and**

Q11. Specification Section 02-221301/3.3/H says if a shutdown value is exceeded that all work must be stopped immediately until a plan is put in place to reduce vibration. Will the successful contractor be compensated for this down time?

A11. **No. The contractor will not be compensated for down time directly associated with work stoppage due to exceeding a shutdown value. As required in Specification 02-221301, the Contractor's VME establishes what the shutdown value is and it is the Contractor's responsibility to ensure that vibrations caused by their means and methods do not exceed this value. Please refer to General Contract Conditions Section 803 for a further understanding of the Contractor's responsibility to protect property from damage.**

Q12. Sheet PFCA-01 has numerous addresses listed with multiple units (apartment mid-rise, residential triplex, residential duplex, apartment low rise, etc...). Will a Pre-Construction Facility Condition Assessment be required to be attempted for each unit at the addresses provided on Sheet PFCA-01?

A12. **Yes. At locations identified as containing multiple units or addresses on Sheet PFCA-01, the registered property owner (as identified by information available from City Assessor's office) for the multi-family units will need to be contacted and coordinated with per the phased outreach plan outlined in Specification Section 02-221301/3.1/B. Should the property owner grant permission for a Pre-Construction Facility Condition Assessment to be performed on their property, the PVIL should coordinate the assessment with the property owner/occupants per requirements established in Specification 02-221301.**

This **ADDENDUM** shall be attached to, become a part of, and be returned with the Bid Proposal.

  
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Lesley B. Thomas, City Engineer

2/14/2020  
\_\_\_\_\_  
Date

\_\_\_\_\_  
The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

\_\_\_\_\_  
Contractor

**ADDENDUM NO. 3**

\_\_\_\_\_  
Date



# DENVER

## TRANSPORTATION & INFRASTRUCTURE

*As of January 1, 2020, the Denver Department of Public Works is now the Denver Department of Transportation & Infrastructure.*

### Marion Street System, Phase 1 Supplemental Specification and Measurement and Payment

February 2020

### 02-221301 Vibration Monitoring, Public Outreach and Pre-Construction Facility Condition Assessment

#### PART 1 - GENERAL

##### 1.1 Summary

The following specification is provided as a reference for Contractors bidding on City and County of Denver Construction Projects. Construction activities are known to produce a specific level of vibration dependent upon the energy output of contractor's machinery, means and methods. The purpose of this specification is to define the contractor's responsibilities prior to, during and post construction. This specification requires the Contractor to obtain the services of a Vibration Monitoring Expert, a Vibration Public Information Liaison and a Facility Condition Assessment Expert. The contractor, and this team, shall be responsible for all aspects of the work, associated within this specification including but not limited to;

- Community outreach and response to questions related to vibration;
- Pre-Construction Facility Condition Assessments looking for risks to property owners and the Contractor;
- Vibration monitoring and reporting.

## **Vibration Monitoring Expert (VME)** See 1.3 Minimum Qualifications

The following minimum qualifications are required for the VME in this specification. The VME shall not be an employee (W2 or 1099) of the contractor. The VME shall be a highly qualified individual retained through separate contract by the Contractor for vibration monitoring. The VME shall be used to fulfill the requirements as stated in this section.

- The contractor shall consult with a VME to ensure adherence to this specification.
- An agreement/contract with a VME shall be provided at the time of award for inclusion in Prevailing Wage and DSBO reporting.
- The contractor's VME shall determine/define a Zone of Influence (ZOI) where planned construction activities create vibration which poses risks to adjacent facilities. See definitions in section 1.2. This determination of a ZOI shall take into account numerous factors including but not limited to; the contractor's means and methods of performing the work, soil types and condition of existing facilities. At a minimum, the ZOI shall extend 250 feet in all directions from any construction activity.
- The contractor's VME shall determine where instruments shall be placed to collect baseline readings prior to any mobilization by the Contractor.
- The contractor's VME shall be responsible for determining the external limits of the ZOI, this shall be defined as the location where vibrations from construction activities attenuate to negligible levels. The external limits shall at a minimum extend 250 feet in all directions from any construction activity.
- The contractor's VME will review the Pre-Construction Facility Condition Assessments to determine the risks from construction activities.
- The VME shall prepare and submit documentation for developing Threshold and Shutdown Values related to the contractor's means and methods, taking into account the findings within the Pre-Construction Facility Condition Assessments.
- Vibration Monitoring Equipment shall have real time reporting capabilities that alert Project Team to values nearing threshold and shut down values, as determined by the Contractor's VME.
- The contractor's VME shall offer formal training to all project participants on how to access any real time, web-based data storage for vibration monitoring.

The Contractor and the contractor's VME shall implement a vibration monitoring/geophone installation plan to document the vibration levels caused by construction activities. When an Exceeds to the Threshold or Shutdown values occurs, the Contractor's means and methods as well as the Threshold and Shutdown values will need to be reviewed. It shall be the Contractor's responsibility to mitigate and prevent further damage to facilities within the ZOI.

## **Public Vibration Information Liaison (PVIL)** <sup>See 1.3 Minimum Qualifications</sup>

The following minimum qualifications are required for the PVIL in this specification. The PVIL shall not be an employee (W2 or 1099) of the contractor. The PVIL shall be a highly qualified individual retained through separate contract by the Contractor for Communication and Outreach. The PVIL shall be used to fulfill the requirements as stated in this section.

The Contractor's PVIL shall be responsible for all communication related to vibration, vibration monitoring or Pre-Construction Facility Condition Assessments for ANY AND ALL PERSONS AND/OR RESIDENTS/OCCUPANTS OF BUILDINGS OR FACILITIES.

- Communication and outreach shall begin no later than 4 weeks after Notice to Proceed (NTP). The mandatory communication and outreach area is defined within 1.2 Definitions. All communication must be coordinated through the contractor's PVIL.
- Mandatory Communication and Outreach Area is defined as a minimum of 500 feet in a radius from the location of the construction activities, dynamic as work progresses.
- The Contractor's PVIL is required to communicate with all facility owners and occupants within the Mandatory Communication and Outreach Area.
- ***The Contractor's PVIL and Facility Condition Assessment Expert shall attempt to gain permission to perform assessments on all facilities within the ZOI (at a minimum of 250 feet in all directions from any construction activity).***

The PVIL shall provide the following services:

- A. The Contractor's PVIL shall provide a local call line for vibration questions related to the Project.
- B. All inquiries shall be responded to within 24 hours, including weekends.
  1. Outgoing message shall inform the caller that all calls will be returned within 24 hours, including weekends.
- C. The Contractor's PVIL shall contact all property owners and residents within the Mandatory Communication and Outreach Area, distributing the approved City and County of Denver document outlining vibration FAQs.
- D. The Contractor's PVIL shall communicate all non-vibration related complaints, concerns, questions, etc. to the City Construction Project Manager or City Public Information Manager
- E. The Contractor's PVIL shall Maintain a written log of all citizen contacts. The log shall include: the nature of the concern, response(s) provided, date of completion for any required remedial action and any necessary future follow up with a frequency.
- F. The Contractor's PVIL shall coordinate all work with the Facility Condition Assessment Expert (FCAE) and the VME to identify all facilities which require assessment in the VME's ZOI.



- G. The Contractor’s PVIL shall attempt to obtain permission to enter private property for initial Pre-Construction Facility Condition Assessment.
- H. The Contractor’s PVIL shall facilitate/schedule all Pre-Construction Facility Condition Assessments.
- I. The Contractor’s PVIL shall coordinate and communicate all activities with the City Construction Project Manager and City Public Information Manager.
- J. The Contractor’s PVIL shall document and record all attempts to contact property owners.
- K. The Contractor’s PVIL shall provide each facility owner and occupant with their specific Pre-Construction Facility Condition Assessment, documenting delivery by obtaining a signature.
- L. The Contractor’s PVIL shall notify all those who occupy, own or operate facilities within the VME’s ZOI of construction activities and any anticipated changes in onsite energy levels.

**Facility Condition Assessment Expert (FCAE)** See 1.3 Minimum Qualifications

The following minimum qualifications are required for the FCAE in this specification. The FCAE shall not be an employee (W2 or 1099) of the contractor. The FCAE shall be a highly qualified individual retained through separate contract by the Contractor for Pre-Construction Facility Condition Assessments. The FCAE shall be used to fulfill the requirements as stated in this section.

- Prior to mobilization, the FCAE shall complete all Pre-Construction Facility Condition Assessments within the initial radial ZOI. The initial radial ZOI shall be determined by the physical location of the contractor’s first planned construction activities. Subsequent Pre-Construction Facility Condition Assessments are dynamic and shall be completed in a timely manner to not impact the Contractor’s critical path schedule activities. see figure 1
- The Pre-Construction Facility Condition Assessment shall document the types and conditions of the facilities within the ZOI.
- All Pre-Construction Facility Condition Assessments shall be coordinated with the Contractor’s PVIL and completed by the FCAE.
- ***The Contractor’s PVIL and FCAE shall attempt to gain permission to perform an assessment on all facilities within the ZOI (at a minimum of 250 feet in all directions from any construction activity).***

**1.2 Definitions**

- A. ***Vibration Monitoring Expert (VME)*** – Individual or company hired by the contractor with specific experience in monitoring construction vibration and who meets the qualifications detailed in 1.3.
- B. ***Zone of Influence (ZOI)*** – shall ultimately be defined by the VME and is determined by the radial extents from a specific construction activity producing vibration that poses risk of damage or impact to a specific structure. At a minimum the ZOI shall extend 250 feet in all directions from any construction activity.

- C. **External limits of the ZOI** - shall be defined by the VME as the location where vibrations from construction activities attenuate to negligible levels. These limits shall at a minimum extend 250 feet in all directions from any construction activity.
- D. **Mandatory Communication and Outreach Area** - defined as a minimum of 500 feet in a radius from the location of construction activities, dynamic as work progresses.
- E. **Public Vibration Information Liaison (PVIL)** – Contractor’s Public Vibration Information Liaison (see minimum qualification section 1.3).
- F. **Facility Condition Assessment Expert (FCAE)** – Contractor’s consultant familiar with structures and facilities who meets the qualifications detailed in 1.3.
- G. **Facilities** - the general term used to identify structures (including but not limited to buildings, garages, sheds, foundations, etc.) within the ZOI of the work.
- H. **Baseline Readings** – initial readings of background vibration levels collected prior to the start of construction.
- I. **Pre-Construction Facility Condition Assessment** – Specific document assessing the condition of all facilities within the ZOI prior to construction activities **(at a minimum of 250 feet in all directions from any construction activity)**.
- J. **Geophone** – Instrument used to measure vibrations near the ground surface.
- K. **Vibration Monitoring Point** – Physical location at which ground vibrations will be monitored during construction.

### 1.3 Minimum Qualifications

The following minimum qualifications are required for each of the roles outlined in this specification. These shall not be employees (W2 or 1099) of the contractor. These shall be highly qualified individuals retained through separate contract by the Contractor for pre-construction facility condition assessments, vibration monitoring and public outreach. These individuals shall be used to fulfill the requirements as stated in this section.

- A. **Vibration Monitoring Expert (VME):** Shall have at least five (5) years of experience with the installation, maintenance, monitoring, reporting and summarizing of data related to the use of vibration instrumentation similar to that specified herein. Shall have completed at least three (3) similar monitoring programs similar in scope to that specified herein within the last five (5) years.
- B. **Public Vibration Information Liaison (PVIL):** Shall have at least five (5) years of experience with information releases and coordinating all aspects of communication between an owner/agency similar to the City and County of Denver, the contractor and the public for large, complex projects in a municipality similar in size to the City and County of Denver. The PVIL shall have completed at least three (3) outreach/communication programs similar to that specified herein within the last five (5) years.
- C. **Facility Condition Assessment Expert (FCAE):** Shall have at least five (5) years of experience assessing the condition of facilities prior to and post construction. Shall have completed at least three (3) condition assessment programs similar to that specified herein within the last five (5) years.

## 1.4 Submittals

All submittals are submitted by the Contractor to the City Construction Project Manager for record-keeping purposes and verification of conformance with the contract documents. These submittals do not shift liability nor relieve the Contractor from full responsibility in the event of damage that is deemed to be caused by the construction operations.

### Pre-Construction prior to NTP

The following information shall be submitted prior to any public outreach performed by the Contractor. The following submittals shall be submitted in the period between Notice To Apparent Low Bidder and NTP; or at a minimum of one week after NTP in order to meet the project specific milestones.

1. Qualification documentation for the FCAE, VME and PVIL as specified in Section 1.3 of this specification.
2. Proposed construction notification letters intended for use on the project, shall be submitted by the Contractor to the City Construction Project Manager for approval a minimum of 1 week after NTP. Please note, that any updated notification letters intended for distribution to the public will require review and approval prior to issuance and may require additional time for coordination through the City and County of Denver

### Preconstruction after NTP

The following information shall be submitted to the City Construction Project Manager prior to the commencement of construction activities, including mobilization, by the Contractor.

1. A map of the Mandatory Communication and Outreach Area.
2. A list of all addresses for facility owners and occupants included in the Mandatory Communication and Outreach Area.
3. Certification that the vibration pamphlet (provided by City Construction Project Manager) and contact information for the PVIL was delivered to all addresses in the Mandatory Communication and Outreach Area.
4. A sample of the daily vibration monitoring report that will be used during construction.
5. All revisions to construction notification letters intended for use on the project, shall be submitted by the Contractor for approval by the City and County of Denver.
6. Vibration instrumentation equipment manufacturer data sheets and calibration certificates meeting the minimum requirements specified under Section 2.1 of this specification.
7. Prior to vibration monitoring instrument installation, the contractor shall submit a certificate issued by the instrument's manufacturer stating that the manufacturer has inspected, calibrated, and tested each instrument before it leaves the factory to see that the instrument is working correctly and has no defects or missing parts.
8. Baseline vibration readings – initial readings of background vibration levels collected prior to the start of construction, along the entire project alignment.

9. Manufacturer data for all equipment to be used during construction activities, including but not limited to excavators, tampers, trucks, jack hammers, front end loaders, pile drivers, etc. along the proposed alignment
10. A technical manual detailing all procedures for accessing vibration monitoring data storage.
11. The ZOI and the external limits of the ZOI prepared by the VME, specific to the contractor's means and methods. This shall include a list of addresses where the PVIL and FCAE will begin requesting permission to perform Pre-Construction Facility Condition Assessments.
12. Pre-Construction Facility Condition Assessments for facilities identified in the ZOI. Submit assessments as they become available.
13. The VME shall prepare and submit documentation for developing Threshold and Shutdown Values related to the contractor's means and methods, taking into account the findings within the Pre-Construction Facility Condition Assessments. If equipment used during construction activities causes an Exceeds to the Threshold or Shutdown values, then the Contractor's means and methods as well as the Threshold and Shutdown values will need to be reviewed.
14. The contractor shall submit contingency plans for when vibration limits exceed Threshold or Shutdown values as specified by the VME.

### **During Construction**

The following information shall be submitted throughout construction.

1. Vibration Raw Data: Collected vibration data shall be submitted when requested by the City Construction Project Manager, at a minimum this data shall be submitted on a weekly basis. Vibration daily reports shall be available within 24 hours of the completion of the previous day's operations.
2. Vibration Weekly Reports: Vibration data collected shall be compiled and submitted on a weekly basis. This should include at a minimum the vibration data recorded and related construction activities (along with locations) occurring during the days' construction.
3. Contingency plan implementation reports: When the construction activities generate an Exceed or Shutdown vibration threshold and contingency responses are necessary, the contractor shall provide a report including location, date and time of Exceed or Shutdown threshold – action taken, supplemental measurements and any correspondence with affected facility owners and occupants.
4. An updated log of calls and concerns received will be submitted to the Contractor's superintendent and forwarded to the City Construction Project Manager and City Public Information Manager on a weekly basis, unless directed otherwise.

### **Post Construction:**

The following information shall be submitted within four (4) weeks following demobilization from the jobsite.

1. The Contractor shall submit a final summary report of all vibration monitoring data at the completion of the project. All vibration monitoring showing exceedance of Threshold or Shutdown values as determined by the VME shall be highlighted and explained in the final summary report.

## **PART 2 - EQUIPMENT**

### **2.1 General**

Vibration monitoring equipment shall be located in areas where unintended disturbance is minimized, and consistent monitoring can be maintained throughout daily construction. All equipment shall be protected from construction activities, vandalism and unintended/intended interference. Each geophone shall be uniquely identified, clearly marked, and collected vibration monitoring data shall be identified accordingly.

- A. Vibration monitoring equipment: Vibration monitoring equipment shall be capable of continuously monitoring and recording vibrations for periods of at least 12 hours; have a seismic range of 0.01 to 10 inches per second with an accuracy of 5 percent of the measured peak particle velocity or better at frequencies between 2 Hertz and 200 Hertz, and with a resolution of 0.01 inches per second or less; include a triaxial geophone; provide real time feedback when Threshold and Shutdown Values are exceeded; and have calibration certificates for all selected vibration monitoring equipment.
- B. A minimum of three geophones shall be used simultaneously to monitor vibrations during all construction activities.

## **PART 3 - EXECUTION**

### **3.1 Public Outreach**

- A. The City and County of Denver vibration pamphlet and PVIL contact information shall be distributed to all facility owners and occupants within the mandatory communication outreach area. This work shall be coordinated by the PVIL and reported to the City Construction Project Manager.
- B. Once the ZOI is determined by the VME, the PVIL shall implement a phased outreach plan for Pre-Construction Facility Condition Assessments and document the success/failure of each phase of the plan. ***At a minimum, every facility within 250 feet in all directions of any construction activity performed shall be contacted in an effort to schedule a Pre-Construction Facility Condition Assessment.*** The PVIL shall attempt to contact all facility owners and occupants within the ZOI as detailed below:
  1. Certified mailing to all occupants and owners of facilities identified within the ZOI requesting cooperation in performing a Pre-Construction Facility Condition Assessment. This document should state that the contractor will be making 3 (three) good faith efforts to gain access to the facility in order to perform a pre-construction condition assessment.

2. Attempt at in-person contact with all occupants identified within the ZOI requesting cooperation in performing Pre-Construction Facility Condition Assessment.
  3. Attempt a second in-person contact with all occupants identified within the ZOI requesting cooperation in performing pre-construction condition assessment.
  4. **If the attempts above fail to generate a response then a “certified – return receipt requested letter” shall be sent to the owner and occupant of each facility identified within the ZOI, who has failed to acknowledge previous contact attempts.**
- C. The PVIL shall be available to attend regularly scheduled meetings of local neighborhood and business associations to discuss vibration issues.
- D. PVIL shall provide interpretation services when requested.

### 3.2 Pre-Construction Facility Condition Assessment

At facilities where successful attempts at contact have resulted in permission to perform a Pre-Construction Facility Condition Assessment; the Contractor shall negotiate legal access to the facility and have the facility owner or occupant sign a document authorizing permission to inspect their property.

This work shall be performed by the FCAE and shall consist of performing Pre-Construction Facility Condition Assessments within the ZOI, after written permission has been granted by the facility owners and occupants. The FCAE shall coordinate with the PVIL and the VME to examine the facilities and prepare permanent reports (as indicated in this specification).

Pre-Construction Facility Condition Assessments shall be conducted along the alignment of work to be performed, in the same direction as construction activities. At the discretion of the City Construction Project Manager, the contractor may be allowed to begin working at the beginning of the critical path schedule, while Pre-Construction Facility Condition Assessments are being completed and documented within the ZOI adjacent to future work activities.

Pre-Construction Facility Condition Assessments shall consist of an individual report for each facility including, at a minimum, the following information:

1. Location of the facility (physical address or GPS coordinates).
2. Date(s) and time(s) of the condition assessment.
3. The type of structure (house, shed, garage, school)
4. Type of foundation for the facility (stacked stone, brick, on grade).
5. Written documentation of the interior (plaster with wallpaper, drywall with wall paper, painted drywall, brick, wood, etc.).
6. Written documentation of the exterior surface material.
  - a. When original exterior surface material is not visible, please annotate as “original exterior covered by façade (vinyl siding, stucco, EIFS)

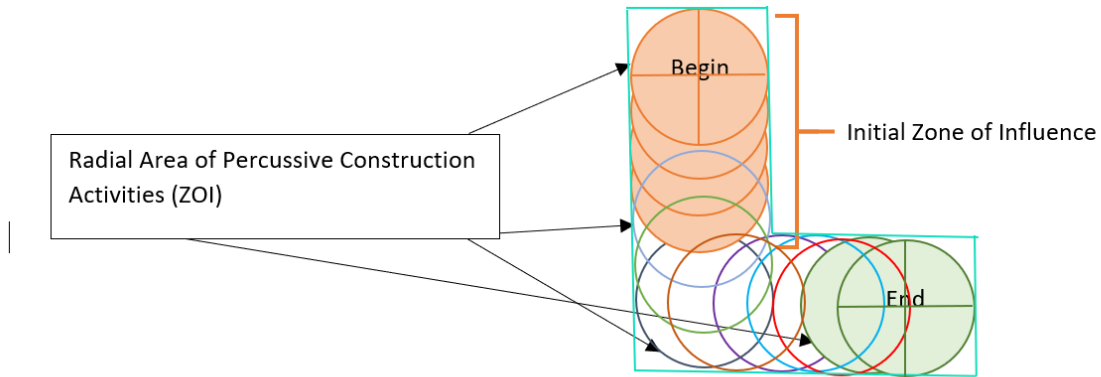
7. Documentation by image, including photos and videos. At a minimum, video and photos shall be taken of the foundation, each corner, above all windows and doorways.
8. Documentation by image of downspout discharge locations in relation to the foundation.
9. Documentation of location (by measurement from a fixed location) of all existing distress or notable defects of drywall, foundations, or the structural components prior to the start of construction.

### **3.3 Vibration Monitoring**

- A. The VME shall provide vibration instrumentation and monitoring to ensure that construction activities have not generated vibration levels that are in excess of the Threshold and Shutdown Values and can provide real time notification when these levels are exceeded.
- B. The contractor shall provide and facilitate safe access at all times for the VME. This includes providing keys for any lock boxes.
- C. All work areas shall have sufficient lighting to facilitate proper performance and inspection of work in accordance with applicable Federal, State, and local laws, safety codes, regulations, and ordinance.
- D. Maintenance
  1. The Contractor shall keep the jobsite and the vicinity of the geophones clean during construction (G.C.C. 325).
  2. Instrument Protection: All instruments and markings shall be protected to avoid being obstructed or otherwise damaged by construction operations or the general public (G.C.C.803).
- E. Installation
  1. Vibration monitoring equipment (Geophones) may only be moved once per day and this must occur prior to daily construction activities. Geophones may not be moved while construction activities are actively occurring. A geophone may only be moved after prior consultation with the VME.
  2. When a Geophone is moved, the contractor shall notify the City Construction Project Manager within 4 hours that the Geophone has been relocated.
  3. All placement and relocation of vibration monitoring equipment shall be coordinated and approved by the VME. This shall be documented and submitted to the City Construction Project Manager on a daily basis.
  4. Vibration monitoring equipment (Geophones) locations shall not be situated immediately above existing utilities and shall be installed per manufacturer's instructions.
  5. Vibration Monitoring Instrumentation Installation: based on the contractor's means and methods, all instrumentation shall be installed at the locations identified by the VME.

6. The construction activities are dynamic, as all work progresses and changes, the vibration monitoring program and equipment may need to increase and/or be placed in additional locations. The VME shall be available at all times during construction activities to assist the Contractor in making decisions.

Figure 1



## F. Monitoring

### 1. Initial Readings:

- a. The VME shall take initial baseline readings of the entire project site prior to commencement of construction, including mobilization. This is to establish a baseline and shall be provided to the Contractor and the City Construction Project Manager. Baseline readings shall be taken at a maximum spacing of every 500 feet along the alignment or at the direction of the VME based upon the Contractor's means and methods.

### G. Frequency

From the time of mobilization until demobilization, the contractor shall provide continuous vibration monitoring any time vibration causing activities are being performed on site. The Contractor's VME shall be responsible for determining if construction activities are vibration causing. The VME shall have the ability to retrieve and review data and inspect the required instrumentation. The VME shall provide the Contractor and the City Construction Project Manager with this data.

### H. Response Values

When a response value from monitoring exceeds the VME's established Threshold or Shutdown Values, the Contractor shall immediately respond in the following manner:

- A) Threshold Value: The Contractor shall meet with the VME and City Construction Project Manager to: 1) review interpretation of the data and results, 2) review the construction means and methods, and 3) determine what changes, if any, shall be made to better control vibration.



- B) Shutdown Value: The Contractor shall **stop all work immediately** and meet with the VME and City Construction Project Manager. The contractor and the VME will develop a plan of action to reduce vibration. At the sole discretion of the City Construction Project Manager, based on recommendation from the VME, some work may continue while a plan of action is being developed.
- C) Once a plan of action is agreed upon by the Contractor, the VME and City Construction Project Manager, modified construction activities may begin.

If a Threshold or Shutdown value is reached during construction, the VME shall submit a detailed vibration report showing a histogram of the event along with the construction operations occurring at the time. This should be submitted within the same time frame as the daily report, or within 24 hours of the completion of the previous day's operations.

#### I. Reporting

- 1. Initial baseline values for vibrations collected prior to the start of construction shall be submitted to the City Construction Project Manager prior to the commencement of construction, including mobilization.
- 2. Vibration monitoring raw data collected throughout the project shall be submitted to the City Construction Project Manager at a maximum of 24 hours after the collection of the data.
- 3. A summary of vibration data shall be submitted weekly including, but is not limited to, the following:
  - a) A description of all construction activities occurring during vibration monitoring.
  - b) A copy of the data sheets of vibration readings and proximity to construction activities to the instrument location at the time of each reading.
- 4. Interpretation: The VME shall provide interpretations of monitoring data and submit them to the City Construction Project Manager along with the data. Data or interpretations shall not be published or disclosed to other parties without advance written permission of the City Construction Project Manager.
- 5. The Contractor shall submit a final summary report of all vibration monitoring data at the completion of the project. All vibration monitoring showing exceedance of Threshold or Shutdown values as presented under this Section shall be highlighted and explained in the final summary report.

**END OF SPECIFICATION**