NOTE TO REVIEWER: The following language is ADDED to the version of the NJTA 2004 Standard Supplementary Specifications which existed prior to the issuance of this DCA.

NOTE TO DESIGNERS:

The following section is "non-standard". It shall be numbered consecutively in the supplementary specifications starting with number 428 regardless of the number shown. For example, if you want to use section 431 - Vertical Realignment of Deck Joint at Structure, but no other non-standard section, it shall be renumbered 428. If another non-standard section is required, it shall be numbered 429., etc.

NOTE TO DESIGNERS:

Some older structures contain asbestos transite ducts encasing existing bearing anchor bolt embedments. As-Built plans should be thoroughly reviewed to ensure that asbestos elements are identified, and that the Contractor is alerted to their presence on the Contract Plans. Requirements for the removal and disposal of transite ducts shall be provided to the Contractor.

Special attention should be paid to placement of proposed layout of anchor bolts so that they clear existing reinforcing bars in the piers intended to remain in service, and also clear above girder flanges, diagonal bracing, diaphragm / floorbeam elements, or other superstructure features which may restrict anchor bolt drilling equipment headroom.

Many older structures contain lead paint in the canvas pads beneath the existing bearing masonry plates. As-Built plans should be thoroughly reviewed to ensure that lead paint coated canvas pads are identified, and that the Contractor is alerted to their presence on the Contract Plans. Handling and Disposal procedures shall be part of the Lead Health and Safety Plan, as per Section 411 of these Specifications.

The Designer shall be responsible for furnishing relevant performance requirements for the isolation bearings on the Contract Plans. These performance requirements include but are not limited to; dead and live load reactions, thermal and seismic displacements, characteristic strengths, elastic stiffnesses, and minimum energy dissipated per cycle. Where large or complex structures and /or difficult soil conditions dictate, multiple performance requirements including multiple spectra shall be included on the Contract Plans and in this specification. Where site-specific and/or geological conditions dictate for large or long structures, multiple spectra may be required to sufficiently analyze the seismic behavior of the total structure. The Designer shall furnish all relevant spectra and their limits on the Contract documents

If it is anticipated that nonlinear dynamic time history analyses will be conducted to verify that Isolators comply with specified performance characteristics, then the Designer shall provide the Contractor spectrum compatible time histories for the spectrum.

The Designer shall, as much as is possible, design and detail masonry plates, sole plates, and their connections to the girders and bearing seats using the best available information. Where information cannot be obtained regarding possible obstructions, such as bearing seat reinforcing to be avoided or other unknown conditions, adequate instruction shall be provided on the Contract Plans requiring field verification/measurement and minimum acceptable requirements. Provided designs and details

shall accommodate the use of all Approved Manufacturers. Coordination with the Approved Manufacturers verifying the suitability of these designs and details shall be obtained and documented.

SECTION 438 – SEISMIC ISOLATION BEARINGS

438.01 DESCRIPTION

This work shall consist of the design, furnishing, testing, and installation of seismic isolation bearing systems (Isolators), and the removal and disposal of the existing bearing assemblies. The Isolators shall meet the dimensional limits and performance requirements as shown on the Plans and specified herein.

The subject structures have been analyzed and designed in accordance with the *2010 AASHTO Guide Specifications for Seismic Isolation Design.* Approved Manufacturers are not required to perform additional analyses provided Isolator characteristics are within 10% of those published within this Specification and on the Plans.

This work shall also include the bearing seat preparation including existing anchor bolt removals, as indicated on the Plans or as otherwise required to install the new Isolators.

This work shall also include the final detailing, furnishing, fabrication, and installation of masonry plates, sole plates, anchor bolts, hardware, and bearing pads as shown on the Plans, described herein, recommended by the Manufacturer, or otherwise required to furnish completely installed and functioning Isolators.

This work shall also include on-site supervision and technical support furnished by the Manufacturer to assist the Contractor with the installation of the Isolators.

438.02 PERFORMANCE REQUIREMENTS

(A) The Isolator is a key structural component which must successfully function in a seismic event at any time throughout the life of the bridge. Isolators must perform reliably under service loads with little or no maintenance.

(B) Temperature Performance - The entire state of New Jersey is located in the Moderate Climate (refer to AASHTO LRFD Bridge Design Specifications 5th Edition, Section 3.12.7.1) which corresponds to a 50 Year low temperature of -30ºF and a maximum period of 14 days where temperatures do not rise above 32ºF. The load factor for the calculation of thermal movements shall be 1.20 as per Subsection 3.4.1 of the same specification. The performance of Isolators in such temperature conditions shall be taken into account in the design. Low temperature moduli for grade 3 Natural Rubber, Lead, and polyurethane as well as low temperature static coefficients of friction for PTFE shall be conservatively estimated or verified by prototype testing.

(C) Long Term Performance - Expected variation in Isolator performance over the lifetime of the bridge shall be incorporated in the Isolator design. Design

considerations for bearings due to variations in long term performance shall incorporate all anticipated changes over the life of the bearings, including consideration of key Isolator system parameters as described in Section C8.1.2 of the 2010 AASHTO Guide Specifications for Seismic Isolation Design.

(D) The ability to select Isolators is dependent upon performance matching. Isolators must possess similar performance characteristics under service and seismic loads. Performance requirements of the Isolators at each isolation location are specified in the Contract Documents and within this Specification. These performance requirements include: force-deflection/energy dissipation characteristics, dead load and live load forces, maximum horizontal force and displacement due to AASHTO Group Loadings in transverse and longitudinal directions, and maximum force and displacement from seismic loads in transverse and longitudinal directions. Failure of an isolation system to adequately match the performance of the system specified in the Contract documents and within this specification shall be cause for the rejection of the Isolator.

438.03 QUALIFIED ISOLATOR MANUFACTURERS

The following Isolator Manufacturers have been approved for use.

Lead-Rubber Seismic Isolation Bearings manufactured by:

Dynamic Isolation Systems, Inc.
885 Denmark Drive, Suite 101
McCarran, Nevada 89434
Telephone: (775) 359-3333

Seismic Energy Products, L.P.
518 Progress Way
Athens, Texas 75751
Telephone: (903) 677-4318

EradiQuake Seismic Isolation Bearings manufactured by:

R.J. Watson, Inc.
78 John Glenn Drive
Amherst, New York 14228
Telephone: (716) 691-3301

Friction Pendulum Isolation Bearings manufactured by:

Earthquake Protection Systems, Inc.
451 Azuar Drive, Building 759
Mare Island, Vallejo, California 94592
Telephone: (707) 644-5993

Substitution of an alternate isolation system not shown above may be acceptable provided all revisions necessary to accommodate this substitution are completed by the Contractor to the satisfaction of the Engineer. All such revisions shall be performed at

no additional cost to the Authority. Reanalysis of the global seismic behavior of the structure will not be required that the provided performance requirements described in this Specification and as shown on the Plans are met by the alternate system.

Where furnished Isolator height varies from dimensions shown on the Plans, the Contractor shall be responsible for adjusting the dimensions of the masonry/sole plates, shims, concrete pedestals or bearing seat elevations. Changes in Isolator Plan dimension (i.e. width and/or length) shall take into consideration the physical limits of the existing abutment seats and/or pier tops. All Isolators shall be centered directly beneath the girder webs. Modifications to existing bearing seats to accommodate Isolator installation, beyond the removal of existing anchor bolts, installing of new anchor bolts, and intentional roughening of the surface to accommodate new grout pads shall only be performed with the approval of the Engineer.

The Isolator properties shown on the Plans have been selected to limit the forces transmitted to substructure units. The bearing characteristics shown on the Plans are for forces and displacement demands computed using the acceleration response spectra with **[an X%]** probability of exceedance in **[XX]** years.

T (sec)	S_a (g)
X.XX	X.XXX
X.XX	X.XXX
X.XX	X.XXX
X.XX	X.XXX
X.XX	X.XXX
X.XX	X.XXX
X.XX	X.XXX
X.XX	X.XXX
X.XX	X.XXX
X.XX	X.XXX

438.04 QUALITY ASSURANCE

Quality assurance shall be performed by the Manufacturer's representative. Tests on materials and completed Isolators shall be supervised by the Manufacturer or its appointed representative. Two (2) copies of the Manufacturer's quality assurance manual shall be submitted to the Engineer for review and approval as Shop Drawings in accordance with Section 104.08 of the Specifications.

438.05 CONTRACT DOCUMENTS, SHOP AND ERECTION DRAWINGS

Calculations conforming to Sections 14.2, 16, and 18.1 of the *2010 AASHTO Guide Specifications for Seismic Isolation Design* and the *AASHTO LRFD Bridge Design Specifications 5th Edition* demonstrating that seismic and service/strength design requirements have been satisfied shall be submitted. Assumptions with regard to Isolator long-term performance and behavior under adverse conditions (thermal, creep, etc.) shall be clearly stated and included in the calculations. Appropriate tests results or studies that verify these assumptions shall also be included. Acceptance of these test results or studies shall be deemed adequate at the sole discretion of the Engineer.

Shop and erection drawings, materials certificates, and testing records necessary or required for the fabrication, testing, and installation of Isolators shall be furnished in accordance with Subsection 104.08 and shall as a minimum consist of the following:

(A) Drawings clearly showing the external dimensions of the Isolators and the mechanisms for substructure and superstructure connections.

(B) Certificates of compliance with material and Isolator test criteria as specified herein or as approved by the Engineer.

(C) Manufacturer's installation instructions, including handling and storage directions.

(D) Manufacturer's Quality Assurance Manual.

(E) Complete record of installed bearings, referenced by serial number.

Where Isolators are specified for installation on an existing structure, no fabrication of any materials including Isolators, masonry plates, sole plates, anchor bolts, hardware, and bearing pads and all other appurtenances required to install a complete and functioning bearing assembly shall be fabricated until such time as all shop drawings for these items have been approved by the Engineer.

438.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

The Isolators are to be delivered in protective packaging for freight and handling purposes. All Isolators shall be stored at the work site in a shelter that provides protection from physical and environmental damage and in the original packaging until installation. Disassembly of the Isolators is not permitted unless approved by the Engineer and supervised by the Manufacturer.

438.07 MARKINGS

Both the packaging and Isolator itself shall bear markings to identify (as a minimum) its installed orientation, order number, Isolator identification number, and lot number. Isolator markings shall be permanent and placed such that they are visible after installation and after coating.

438.08 MATERIALS AND MATERIALS TESTING

Testing shall be performed in accordance with the below. Testing means and methods not governed by the below shall be as per the *AASHTO Guide Specifications for Seismic Isolation Design*, the *2010 AASHTO LRFD Bridge Construction Specifications.*

Certificates of compliance with material test criteria as specified herein shall be provided to the Engineer.

(A) Lead-Rubber Seismic Isolation Bearings

(1) The elastomer of the Isolators is to be natural rubber, Type NR Grade 3 [Low Temperature Elastomer Grade less than 3 shall not be permitted] per ASTM D4014-89 and conforming to the following requirements:

(a) Heat Resistance - ASTM D573 (158°F for 7 days)
Change in Durometer Hardness: 10 Shore A points maximum
Change in Tensile Strength: maximum of -25%
Change in Ultimate Elongation: maximum of -25%

(b) Compression Set - ASTM D395 Method B (158°F for 22 hours)
Permissible set: 25% maximum

(c) Ozone Resistance - ASTM D1149
100 hours mounting procedure ASTM D518 Procedure A
50±5 pphm ozone in air by volume, 20% strain 100°F ± 2°F
No visible cracks at 7X magnification.

(d) Low Temperature Properties
Low Temperature Compression set ASTM D1229
Compression Set at 14°F for 7 days @ 25% compression:
Permissible set 65% maximum.
Low Temperature Brittleness ASTM D746 Procedure B
Brittleness at -40°F; No Failure permitted
Instantaneous Thermal Stiffening ASTM D1043
Stiffness at -40°F shall not exceed 4 times the stiffness measured at 73°F.
Low Temperature Crystallization Annex A ASTM D4014
Quad Shear Test at -15°F for 14 days
Stiffness shall not exceed 4 times the stiffness measured at 73°F.

(e) Bond of Elastomer to Steel Laminate ASTM D429 Method B
Peel strength: 40 lb/in minimum.

(f) Tensile Strength and Ultimate Elongation of Elastomer ASTM D412
Tensile Strength: 2250 psi minimum.
Ultimate Elongation: 550% minimum

(g) Shear Modulus at 50% Shear Strain of Elastomer ASTM D4014
Shear modulus of the elastomer at 50% shear strain is to be determined.

(2) All steel plates incorporated in the seismic isolation devices shall conform to the following requirements:

(a) Steel laminates used for reinforcement shall be made from rolled mild steel conforming to ASTM A36, A1011 or equivalent. The laminates shall have a minimum nominal thickness of 12 gauge. Plates shall be sandblasted and cleaned of all surface coating, rust, dirt, and mill scale to an SSPC SP-6 level surface preparation before bonding.

(b) All edges on surfaces to be bonded to the elastomer (including perimeter of the central hole) will be deburred and made smooth to remove any sharpness. All corners (in plan) will have a 1/4 - inch minimum radius.

(3) Purity of Lead: The purity of Lead shall be established by chemical analysis from a sample of that used in the Isolators and shall possess a minimum purity of 99%. Lead shall also conform to ASTM B29.

(4) Structural steel mounting, sole, and masonry plates are to conform to ASTM A709 grade 36 or 50 and all requirements of Section 403 - STEEL STRUCTURES.

(B) EradiQuake Seismic Isolation Bearings

(1) Polyether Urethane Rotational Element shall conform to the following requirements in:

Physical Properties	ASTM Test	Min	Max
Hardness (Durometer 'D')	D2240	60	64
Tensile Stress (psi)			
at 100% elongation	D412	2000	----
at 200% elongation	D412	3700	----
Tensile Strength (psi)	D412	5000	----
Ultimate Elongation (%)	D412	220	----
Compression set (%)			
22 hrs @ 158^{o}F	D395	----	40

(2) Stainless Steel shall conform to ASTM A167 Type 304 or ASTM A240 Type 304. Stainless steel in contact with PTFE sheet shall be polished to a No. 8 bright mirror finish. The minimum thickness of the stainless steel shall be as per Section 16.3.2 of the *2010 AASHTO Guide Specifications for Seismic Isolation Design*

(3) Polytetraflourethylene (PTFE) Sheet shall be as per Section 16.2.2 of the *2010 AASHTO Guide Specifications for Seismic Isolation Design*

(4) Mass Energy Regulator (MER) spring material shall be manufactured by a method that limits variations in the performance of this material over its design life and expected temperature performance range. Variations in material behavior shall be verified by appropriate test or time history studies and incorporated in the design. Acceptance of these test results or studies shall be deemed adequate at the sole discretion of the Engineer.

(5) Structural steel mounting, sole, and masonry plates are to conform to ASTM A709 Grade 36 or 50 and all requirements of Section 403 of the Specifications.

(6) Connections of the MER shall be corrosion resistant and shall perform without binding throughout the 75-year design life of the Isolator.

(C) Friction Pendulum Isolation Bearings

(1) The material for the stainless steel for the main concave spherical sliding surfaces shall conform to ASTM Designation A240, Type 304 or 316 stainless steel, equal or better.

(2) The compressive yield strength of the Isolator material shall be at least two times the maximum design bearing pressure.

(3) Other structural components shall conform to ASTM Designation A36, A576, A572, A536, equal or better.

438.09 FABRICATION

Fabrication shall be performed in accordance with the below. Fabrication means and methods not governed by the below shall be as per the *AASHTO Guide Specifications for Seismic Isolation Design*, the *2010 AASHTO LRFD Bridge Construction Specifications.*

All steel surfaces exposed to the atmosphere, except stainless steel or low friction surfaces, shall be coated in accordance with the Plans and Specifications. The surfaces to be coated shall be shown on the working drawings. Coatings shall not impair the clarity of the bearing identification markings. Prior to coating, the exposed steel surfaces shall be cleaned in accordance with the recommendations of the coating manufacturer. Metal surfaces to be welded shall be given a coat of clear lacquer, or other protective coating as approved by the Engineer, if the time of exposure before welding is to exceed three months. The coating shall be removed at the time of welding. No coating will be done to these surfaces prior to welding

Bearings for Steel Superstructures shall be painted in accordance with Specification Section 411. Quality assurance inspection of coatings will be in accordance with Specification Section 411.

Bearings for Concrete Superstructures shall either be galvanized in accordance with ASTM A-123 or ASTM A-153, as appropriate, or zinc metalized in accordance with AWS C2.2 to a finished coating minimum thickness of 10 mil. Quality assurance inspection will be performed by using magnetic thickness gauges.

The Contractor shall provide the Engineer with written notification thirty (30) days prior to the start of Isolator fabrication. This notification shall include all of the information required as a part of the shop drawing submission(s).

Where indicated in the Plans, preformed fabric pads used as bedding shall conform to the requirements of Section 923.02.

(A) Lead-Rubber Seismic Isolation Bearings

(1) The tolerances of the Isolator dimensions shall be as follows:

Dimension	Tolerance
Thickness of Individual Rubber Layers	±20% of design Value no more than ± 1/8 inch
Thickness of Top and Bottom Cover Rubber	+0, -1/16 inch
Rubber Bearing External Plan Dimensions and Shim Plan Dimensions	± 1/8inch
Masonry and Sole Plate External Plan Dimensions	± 1/4inch
Flatness of Exterior Top and Bottom Surfaces of Completed Bearing	± 1/32 inch from mean surface
Variation from Plane Parallel to the Theoretical Surface	
Top	Slope relative to the bottom of no more than 0.005 radians or not to exceed dimensional tolerances, whichever controls.
Sides	± 1/8inch
Overall Bearing Height with masonry and sole plates	± 1/4
Diameter of Central Core	± 1/32 inch

(B) EradiQuake Seismic Isolation Bearings

(1) The finish of the mold used to produce the polyether urethane element for disk bearings shall conform to best machine shop practices. The shear restriction mechanism shall be connected to the bearing plate by welding or other acceptable means.

(2) Stainless steel sheets shall be attached to their steel substrates with a continuous seal weld.

(3) All welding shall conform to, and all welders shall be qualified in accordance with, the requirements of the ANSI/AASHTO/AWS D1.5 *Bridge Welding Code.*

(4) Except as noted, all bearing surfaces of steel plates shall be finished to machine flat within 0.010 inches per foot. Out-of-flatness of greater than 0.010 inches per foot on any plate shall be cause for rejection. The bottom surfaces of lower bearing plates (masonry plates) designed to rest on bearing pads shall not exceed an out-of-flatness value of 0.0625 inches. Oxygen cut surfaces shall not exceed a surface roughness value of 1000 microinches, as defined by ANSI B46.1.

(5) After assembly including sole plates and masonry plates, Isolator components shall be held together with steel strapping, or other means, to prevent disassembly until time of installation. Packaging shall be adequate to prevent damage from impact as well as from dust and moisture contamination during shipping, storage, and installation.

(C) Friction Pendulum Isolation Bearings

(1) The manufacturing methods and quality control shall be in conformance with Section 17 of the *2010 AASHTO Guide Specifications for Seismic Isolation Design*

(2) An approved self-lubricating bearing liner material shall be attached via approved means to the articulated slider and housing.

(3) All structural welding shall conform to, and all welders shall be qualified in accordance with, the requirements of the ANSI/AASHTO/AWS D1.5 *Bridge Welding Code*.

(4) The external Isolator Plan dimensions shall be within ± ½" of the values shown in the bearing drawings.

(5) The Isolator height shall be within ± ¼" of the values shown in the Isolator drawings.

438.10 ISOLATOR TESTING

Certificates of compliance with Isolator test criteria as specified herein shall be provided to the Engineer.

The deformation characteristics and damping values of the Isolators used in the design and analysis shall be based upon prototype tests conducted to meet the requirements in Section 13 of the *2010 AASHTO Guide Specifications for Seismic Isolation Design*. Such tests must validate design properties that may be extrapolated to the actual sizes used in the design.

In addition, prototype testing described in Sections 13.2.2.5 of the *2010 AASHTO Guide Specifications for Seismic Isolation Design* shall be performed at standard room temperature and at -5 degrees Fahrenheit for elastomeric bearing designs. Material Friction Testing for sliding surfaces as described in Section 18.1.5.2.3 of the *2010 AASHTO LRFD Bridge Construction Specifications* shall be performed at standard room temperature and at -5 degrees Fahrenheit for bearing designs with sliding surfaces. Acceptable system property variations in the prototype tests shall be +/- 10% of the design properties.

Note that prototype tests are to be conducted on the assembled Isolator (not individual Isolator components) and that these prototype tests are *in addition* to the tests specified below.

Quality control tests, as defined in the *2010 AASHTO Guide Specifications for Seismic Isolation Design* shall be carried out on all bearings to be installed on the bridge. For combined compression and shear quality control tests, a continuous plot of the shear load and shear deflection will be recorded to permit an evaluation of the hysteretic performance of the Isolators.

(A) Lead-Rubber Seismic Isolation Bearings

Quality control tests shall be performed on each Isolator in accordance with Section 15.2 of the *2010 AASHTO Guide Specifications for Seismic Isolation Design* with the following added provisions:

(1) Combined Compression and Shear Tests - Each Isolator will be loaded in compression to the maximum applied dead load plus 50% live load for the particular Isolator type. The compression load will be maintained while the Isolator is deflected in shear. Each Isolator shall be visually inspected both during and after testing. Any resultant defects, such as bond failure, physical destruction, or permanent deformation shall be cause for rejection. Defects such as torn or deformed elastomer or laminate fault shall also be cause for rejection.

(B) EradiQuake Seismic Isolation Bearings

Quality control tests shall be performed on each Isolator in accordance with Section 17.2 of the *2010 AASHTO Guide Specifications for Seismic Isolation Design* with the following added provisions:

(1) Compression Capacity Tests - Each Isolator will be loaded in compression to the 1.5 times the maximum applied dead load plus 50% live load for the particular Isolator type. Each bearing shall be visually examined both during and after testing. Any resultant defects, such as bond failure, physical destruction, or cold flow of PTFE to the point of debonding shall be cause for rejection. Defects such as extruded or deformed elastomer or cracked steel shall also be cause for rejection.

(2) Combined Compression and Shear Tests - Each Isolator will be loaded in compression to the maximum applied dead load plus 50% live load for the particular Isolator type. The compression load will be maintained while the Isolator is deflected in shear. Upon review of the load deflection curves, if there is any indication of binding or other undesirable response the MER shall be rejected. Each Isolator shall be visually inspected both during and after testing. Any resultant defects, such as bond failure, physical destruction, or cold flow of PTFE to the point of debonding, shall be cause for rejection. Defects such as extruded or deformed elastomer or cracked steel shall also be cause for rejection.

(C) Friction Pendulum Isolation Bearings

Quality control tests shall be performed on each Isolator in accordance with Sections 17.2 and 18.4 of the *2010 AASHTO Guide Specifications for Seismic*

Isolation Design with the following added provisions:

(1) Compression Capacity Tests - Each Isolator will be loaded in compression to the 1.5 times the maximum applied dead load plus live load for the particular Isolator type. Each bearing shall be visually examined both during and after testing. Any resultant defects, such as bond failure, physical destruction, or cold flow of low friction material to the point of debonding shall be cause for rejection.

(2) Combined Compression and Shear Tests - Each Isolator will be loaded in compression to the maximum applied dead load plus live load for the particular Isolator type. Each Isolator shall be visually inspected both during and after testing. Any resultant defects, such as bond failure, physical destruction, or cold flow of low friction material to the point of debonding, shall be cause for rejection.

(3) Wear test data for sliding surface materials shall be submitted for review and approval. Only sliding surface materials which have been previously used in a bridge bearing application for no less than 10 years may be submitted for approval. The wear data shall support an anticipated bearing service life of a minimum of 75 years.

438.11 INSTALLATION

Where Isolators are to be installed on existing structures, final location of anchor bolts shall be the responsibility of the Contractor. Existing bearing seat reinforcing bars shall be avoided when installing Isolator anchor bolts. Locations of new anchor bolts and existing bearing seat reinforcing bars shall be submitted as part of the Isolator shop drawings. Where steel reinforcing bars cannot be avoided for new anchor bolt installations, the Contractor shall contact the Engineer immediately.

The Contractor shall furnish the services of a competent technical representative of the Manufacturer at no additional cost to the Authority. The technical representative shall be present at the work site prior to the start of any installation of Isolators to instruct the Contractor and the Engineer on installation and inspection procedures. The Manufacturer's technical representative shall supply detailed instructions supplementing those specified herein to for use in installing the Isolators. The Contractor shall be thoroughly familiar with the procedures recommended by the Manufacturer before installation of the system. The Contractor shall furnish the Engineer with a copy of the Manufacturer's printed installation procedures.

Bearing surfaces located at improper elevations or not set level or true to plane shall require either grinding of the surface, grout pack of bearing seats, or modification of the Isolator such that the intended Isolator placement is as originally designed with the least amount of Isolator modification.

The Isolators shall be installed level and normal to the gravity loads. Superstructure gradients or tilted girder flanges shall be accommodated with beveled sole plates. Isolators shall be placed on surfaces that are plane to within 1/16 of an inch and horizontal to within 0.001 radians. Any lack of parallelism between the top of the

Isolator and underside of the girder shall be corrected to the satisfaction of the Engineer.

There shall be no obstructions, including bolt extensions, which prevent the Isolators from deforming horizontally in any direction. The area around each Isolator shall be cleaned of debris and construction materials prior to acceptance of the installed Isolator.

Any welding performed on steel in contact with or near the Isolator shall be performed in such a manner as to not damage the Isolator. Caution shall be taken to ensure that the steel temperature directly adjacent to the rubber or polyether urethane elements does not exceed 212°F. Rubber or polyether urethane elements must not be exposed to direct flame or sparks.

Upon completion of all bearing installations, the Contractor shall provide a complete record of the location of each installed Isolator, referenced by serial number, to both the Engineer and the Manufacturer.

438.12 CERTIFICATES OF COMPLIANCE

The Isolator Manufacturer shall submit Certificates of Compliance for the Isolators indicating that the materials, fabrication, testing, and installation meet the requirements of the Specifications.

438.13 MEASUREMENT

Seismic Isolation Bearing, Type __ shall be measured by the actual number of each type of Isolator installed.

438.14 PAYMENT

Payment will be made under:

PAY ITEM	PAY UNIT
Seismic Isolation Bearing, Type __	Each

Payment for **Seismic Isolation Bearings** shall include all work associated with design, fabrication, delivery, and construction support required to install the bearings and associated hardware. No separate payment will be made for bedding material, anchor bolts, sole plate, masonry plate, coatings, or field welds required to install the bearings.

No separate payment will be made for costs required to provide on-site construction support to the Contractor.

No separate payment made for additional seismic isolation bearings and bearing material required for testing.

Removal and safe disposal of canvas pads coated in red lead shall be incidental to the **Seismic Isolation Bearing** items.

Removal and disposal of existing bearings and anchor bolts shall be incidental to the

Seismic Isolation Bearing items.

Payment for removal, handling, and disposal of asbestos shall be paid for under **Removal of Asbestos (No-Bid item)**.