

**STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION**

**ADDENDUM NO. 2
for
HIGH FRICTION SURFACE TREATMENT INSTALLATION
AT VARIOUS LOCATIONS ON OAHU**

FEDERAL-AID PROJECT NO. NH-0300(181)R

FEBRUARY 17, 2023

This addendum shall make the following amendments to the Bid Documents:

A. NOTICE TO BIDDERS

1. Prospective bidders are hereby notified that the receiving of bids, scheduled for 2:00 PM Hawaii Standard Time (HST), February 24, 2023 is postponed to 2:00 PM HST, March 03, 2023. The attached Notice to Bidders dated r2/17/2023 shall be incorporated and made a part of the original Notice to Bidders.

B. SPECIFICATIONS

1. Delete Section 421 dated 01/10/2023 in its entirety and replace with attached Section 421 dated r02/17/2023.

Please acknowledge receipt of this Addendum No. 2 by recording the date of its receipt in the space provided on page P-4 of the Proposal.



ROBIN K. SHISHIDO
Deputy Director, Highways Division

NOTICE TO BIDDERS
(Chapter 103D, HRS)

The receiving of SEALED BIDS for HIGH FRICTION SURFACE TREATMENT INSTALLATION AT VARIOUS LOCATIONS ON OAHU, FEDERAL-AID PROJECT NO. NH-0300(181)R will begin as advertised in HlePRO. Bidders are to register and submit bids through HlePRO only. See the following HlePRO link for important information on registering:

<https://hiepro.ehawaii.gov/welcome.html>.

Deadline to submit bids scheduled for 2:00 PM Hawaii Standard Time (HST), February 24, 2023, is HEREBY POSTPONED until **2:00 PM HST, March 03, 2023**. Bids received after said due date and time shall not be considered.

Bidders are directed to read and be familiar with the Disadvantaged Business Enterprise (DBE) Requirements, which establishes the program requirements pursuant to Title 49 Code of Federal Regulations Part 26 and, particularly, the requirements of certification, method of award, and evidence of good faith. All bidders must e-mail the Engineer at sharen.h.cho-ibanez@hawaii.gov, the Disadvantaged Business Enterprise (DBE) Contract Goal Verification and Good Faith Efforts (GFE) Documentation for Construction, Disadvantaged Business Enterprise (DBE) Confirmation and Commitment Agreement – Trucking Company and Disadvantaged Business Enterprise (DBE) Confirmation and Commitment Agreement – Subcontractor, Manufacturer, or Supplier by **March 8, 2023 at 4:30 PM HST**. Failure to provide these documents shall be cause for bid/proposal rejection.

All bidders must email the list of past projects per Section 102.03 of the specifications to sharen.h.cho-ibanez@hawaii.gov by **March 8, 2023 at 4:30 PM HST**. Failure to provide the list of past projects shall be cause for bid/proposal rejection. If the lowest responsive bidder does not meet the minimum qualification requirements of a minimum 3,000 square yards of high friction surface treatment placed in the last 3 years, such bid shall be rejected as non-responsible. The Department will then consider the next lowest responsive and responsible bidder for award.



ROBIN K. SHISHIDO
Deputy Director, Highways Division

1 Make the following Section a part of the Standard Specifications:
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4 **“SECTION 421 – HIGH FRICTION SURFACE TREATMENT**
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7 **421.01 Description.** This section describes furnishing and applying a high
8 friction surface treatment (HFST) system on a prepared surface as specified and
9 in conformity with the lines and details shown on the plans.
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11 **421.02 Materials.**
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13 **(A) General.** Use a two-part modified exothermic epoxy or polymer resin
14 binder treatment containing epoxy or polymer binder capable of retaining a
15 bauxite aggregate topping under vehicle conditions. Reference to epoxy
16 binder herein refer also to polymer binder unless otherwise specified.
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18 **(B) Epoxy or Polymer Binder:** The epoxy binder shall consist of a
19 thermosetting modified epoxy compound which holds the aggregate firmly
20 in position. The epoxy binder shall meet the requirements in TABLE
21 421.02-1 EPOXY OR POLYMER BINDER requirements.
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TABLE 421.02-1 EPOXY OR POLYMER BINDER		
Property	Requirements	Test Method
Ultimate Tensile Strength	2,500 psi min.	ASTM D638
Compressive Strength	1,600 psi min.	ASTM D695
Gel Time	10 minutes min.	ASTM D2471
Water Absorption	Less than 0.50%	ASTM D570
Shore Hardness	65 min.	ASTM D2240
Viscosity	3,000 cP	ISO 2555
Cure Rate	3 hours max.	Thin Film @ 75 °F
Mixing Ratio	*	n/a

23 *As recommended by the Manufacturer

24 Two-part epoxy materials which are not exothermic in curing and do
25 not meet the viscosity requirements will not be allowed. Independent
26 laboratory report documents shall be current, not older than 12 months old,
27 and shall provide documentation that the epoxy binder meets the
28 requirements in this section.
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30 **(C) Aggregate Topping:** The aggregate topping shall be a calcined
31 bauxite consisting of a 1-3 mm nominal-size polish- and abrasion-resistant
32 aggregate. The aggregate will be delivered to the construction site in plastic
33 wrapped bags or super sacks, with Manufacturer's information clearly
34 labeled. Wrapping shall protect from moisture and contamination to

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maintain aggregates clean, dry, and free from foreign matter. The aggregate shall meet the requirements in TABLE 421.02-2 AGGREGATE REQUIREMENTS.

TABLE 421.02-2 AGGREGATE REQUIREMENTS		
Property	Requirement	Test Methods
Aggregate Abrasion Value	10% max.	LA Abrasion Test
Moisture Content	0.2% max.	AASHTO T255
Aluminum Oxide	87% min.	ASTM C25
	Sieve Designation	Requirement
Aggregate Gradation	No. 6 Sieve Size	95 % min. Passing
	No. 16 Sieve Size	5% max. Passing

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(D) Certification. Submit certification from the manufacturer that the aggregate meets the above requirements. Submit documentation of the in-place friction characteristics (minimum 65 FN40R in accordance with ASTM E274) of aggregate bonded to a vehicular bearing surface using the modified epoxy binder.

(E) Storage of material. Materials shall be stored in accordance to the manufacturer's recommendations.

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Safety Data Sheet (SDS), Product Data Sheet, and other information pertaining to the safe practices for the storage, handling, and disposal of the materials, and to their health hazards shall be obtained from the manufacturer and posted at storage areas and shall be submitted to the Engineer.

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421.03 Construction.

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- (A) General:** Submit a project-specific QC plan to include the following:
- Surface preparation methods for areas where HFST is to be placed.
 - Method of protecting areas and exposed facilities not to receive HFST.
 - Method of protecting and reestablishing existing longitudinal and transverse joints and working cracks in concrete pavements and structures.
 - Type of binder to be used.
 - Certified instruments to assure that the ambient conditions are compliant. Wet film thickness gauge to make thickness measurements of the binder.
 - Binder manufacturer's recommended mixing and placement instructions, including mixing ratios and temperatures.
 - Binder manufacturer's estimated cure times for resin binder to be used using anticipated local ambient temperatures.

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- Method for safe storage and handling of HFST components.
- Disposal methods for excess HFST, debris, and containers for HFST components.
- Contingency plan that describes corrective actions to be taken in the event of equipment failure or material issues, etc. during HFST placement.
- Corrective actions to address irregularities or unsatisfactory final surface.

1. **Training.** QC plan must be submitted to the Engineer and accepted before training can be held. The HFST manufacturer's representative, who must be knowledgeable about the components of the HFST and its installation must train HDOT, the contractor's personnel, e.g., supervisor, foreman, operator, workers who will be involved in the HFST installation. Handouts shall be provided. The manufacturer's representative shall report to the construction site prior to surface treatment and shall be present during preparation and application for the test strip and first full location. Complete training a minimum of seven days ahead of the first installation of HFST. Topics of the training to include:

- Surface Preparation,
- Treatment of cracks and protection of working joints and cracks,
- Acceptable vs unacceptable surface conditions,
- Acceptable ambient weather conditions,
- Mixing of the binder.
- Distribution of the HFST binder and HFST aggregate
- QC procedures to be taken, e.g., wet film thickness measurements, ambient weather conditions, pavement temperature.

2. **Test Strip.** At a location chosen by the Engineer, install a test strip of the HFST. The Contractor may suggest suitable test strip locations for acceptance. The test strip shall be done before production installation of the HFST is started. The manufacturer's employed representative shall be present at the installation of the test strip. The test strip shall use all the personnel, material, equipment, i.e., means and methods the Contractor intends to use during the production of the HFST. The test strip shall demonstrate the Contractor's ability to do HFST work that meets the requirements of the Contract Documents. The Engineer may reject or deem the test strip acceptable with comments. Adjust means and methods to address the engineer's comments, or if considered extra work requiring a contract change order and additional cost or contract time or both inform the Engineer in writing.

Construct test strips of 50-linear feet minimum length and one lane

118 minimum width of the lanes within the project area. The test strip
119 shall demonstrate the hand or mechanical application method or
120 both if both application method is to be used and for application on
121 AC and PCC pavements. In those cases, four test strips shall be
122 constructed. When a mechanical method is used, check that the
123 machine has been properly calibrated. Verify application rates and
124 cure time. No HFST production installation shall take place until an
125 acceptable test strip for the method used is installed. The test strip
126 will be part of the HFST quantity of the project when accepted by the
127 Engineer. If the test strip is not found acceptable, remove and
128 restore test strip area. This shall be at the Contractor's cost and no
129 additional time shall be given. Redo the test strip until it is acceptable
130 to the Engineer. Conduct a post-installation meeting with the
131 manufacturer's representatives, HDOT, and the Contractor's
132 personnel after the installed test strip area has been open to traffic,
133 and HDOT has had an opportunity to inspect the test strip area.
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135 3. HFST installation work must not start if any of the following conditions
136 exist:

- 137 • Pavement surface preparation is not acceptable to the Engineer
- 138 • Pavement surface is wet
- 139 • The ambient and/or surface temperature is below 40 °F or above
140 105° F, or when the anticipated weather conditions would prevent
141 the proper application of the surface treatment as determined by
142 the manufacturer's representative. Conditions include rain within
143 6 hours of application or forecast over 40%. Recommend waiting
144 at least 24 hours after rain before application.
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146 For unaccepted HFST application, square the end of the accepted HFST
147 making an edge of the last finished HFST. Remove the remaining
148 unfinished HFST material in a manner that will not impact the newly
149 placed HFST or the installation of the HFST that will be placed over the
150 area.
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152 **(B) Preparation.** Surfaces shall be clean, dry and free of all deleterious
153 materials e.g. dust, oil, debris, tar, prior crack treatment etc. and any other
154 material that might interfere with the bond between the HFST material and
155 existing surface before the start of HFST application.

156 Use detergent or cleaners and water to remove oil. Remove
157 detergent/cleaner-water liquid from the pavement surface to a degree that
158 it does not affect the bonding properties of the binder to the pavement. A
159 4,000-psi minimum hydropower washer, i.e., water blasting system, may
160 also be used to clean and remove oil and other deleterious material from
161 the pavement's surface. Allow pavement to dry to the required maximum
162 allowable pavement moisture before application of HFST.

163 The texture of the concrete surface profile of the portland cement
164 concrete surfaces must be achieved by shot blasting or hydrodemolition.

165 Shot blasting and hydrodemolition equipment must be equipped with a fully
166 functioning vacuum recovery of shot or water and debris. When using
167 hydrodemolition the pressure at the nozzle must be approximately 25,000
168 psi minimum or an Engineer accepted pressure needed to achieve the
169 required textures. The nozzles must be in close proximity to the pavement
170 surface.

171 Existing asphalt pavement surfaces that have a seal coat or a dense
172 mix design or are embedded with dirt and pavement with potentially
173 detrimental contaminants must be prepared by shot blasting or water
174 blasting.

175 Clean the concrete or asphalt pavement surfaces by using dry, oil-
176 free compressed air (185 cfm min) and mechanical broom or with vacuum
177 to remove all dust and other loose material. Grind, shot blast, or hydrowash
178 any remaining concerned areas. Perform a final blowdown using 185 cfm
179 dry, oil-free compressed air. Adequate cleaning of all surfaces must be
180 determined by the manufacturer's employed representative and the
181 Engineer, or solely the Engineer in the absence of the manufacturer's
182 representative.

183 Check pavement before and after cleaning for conditions that must
184 be addressed before application of HFST. The conditions to be addressed
185 and recorded only and is not intended to be included within the scope of this
186 project. Conditions include, but are not necessarily limited to:

187 Asphalt pavement

- 188 • Rutting that is 0.25 inches or deeper.
- 189 • Raveling of the surface course.
- 190 • Bleeding surface mix.
- 191 • Cracking in or outside the wheel path that covers 6 percent or
192 more of the surface.

193 Concrete pavement, slab replacement is required for:

- 194 • Any single slab with moderate or severe distress (transverse
195 cracking, longitudinal cracking, patching, spalling, and corner
196 cracking).
- 197 • Any single shattered slab in more than 3 pieces.
- 198 • Cracking in or outside the wheel path that covers 6 percent or
199 more of the surface.

200 Slab replacement must be a full-depth repair with dowels and tie-
201 bars. The repair area must be from the existing joint to the existing
202 joint.

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204 Protect utilities, drainage structures, curbs, joints and any other
205 structure within or adjacent to the treatment location against the application
206 of the surface treatment materials.

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208 Remove by grinding or using a high-pressure water blasting/hydro-
209 blasting system with vacuum recovery of water and debris all permanent
210 and work zone pavement markings that conflict with the surface
211 application.

212 All wet areas must be left to dry, squeegeed, and if needed, dried
213 with a hot torch air blaster lance/heat lance or similar drying tool accepted
214 by the Engineer. All drying of the pavement must be completed
215 satisfactorily before the application of HFST starts. Pavement Marking tape
216 may be peeled or burned off; however, all remnants or burn marks must be
217 hydro-blasted.

218 Remove all pavement markings debris with a mechanical broom with
219 vacuum recovery of water and debris. Fill all depressions caused by the
220 removal of the pavement markings with a binder material, letting it set
221 before proceeding with the application of the HFST. The pavement surface
222 cleaning must be followed by a final blowdown using 185 cfm minimum dry,
223 oil-free compressed air before the start of the HFST application.
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225 Pre-treat joints and cracks, other than Portland cement concrete
226 working joints, greater than 1/4 inches in width and depth, and as directed
227 by the engineer, with the mixed epoxy specified herein. Treatment of joints
228 and cracks shall be in accordance with the manufacturer's employed
229 representative.
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231 HFST application must not start until the binder in the pre-treated
232 joints and cracks has gelled. Consider, be attentive to, and make
233 accommodations for conditions that may affect gel time of the binder. e.g.,
234 long runs, pavement temperature, and ambient temperature, since gelling
235 can occur faster with warmer temperatures.
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237 The installation of HFST must not start for application on new
238 underlying and adjacent to new asphalt concrete or portland cement
239 concrete pavement surfaces, including patches or repair areas using those
240 materials, until a minimum of 30 days after completion of the pavement or
241 repair.
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243 **(C) Mixing and Application of Epoxy Binder and Aggregate Wearing**
244 **Surface.** Utilize one of the following methods for application of the
245 binder and aggregate wearing course, as applicable. Use instruments to
246 assure that the ambient conditions are compliant. Take measurements
247 immediately before and during the application of the HFST binder. Using
248 a wet film thickness gauge make thickness measurements during the
249 application of the binder and perform every 50 linear feet.
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- 251 **1. Hand mixing and application.** Method must be used only for:
- 252 • Low volume application areas, e.g., intersections, areas less
253 than 250 square yards, or
 - 254 • Where truck mounted machines cannot be used due to the
255 specified location's logistical restrictions.
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257 Proportion the two-part modified epoxy base binder components, Part A
258 and Part B to the correct ratio as recommended by the Manufacturer and

259 mix using a low speed, high torque drill fitted with a helical stirrer. The
260 stirrer shall be a Jiffy Mixer or an Engineer accepted equivalent.
261 Manually apply the mixed components onto the prepared pavement
262 surface at a thickness of 60 mil +/- 5 mils Uniformly spread the hand
263 applied base binder onto the substrate. The average wet thickness must
264 be approximately 60 mils. Spread the binder by hand onto the substrate
265 using a method that will generally achieve a uniform thickness of 60 mils.
266 Immediately, spread the high friction surfacing aggregate onto the two part
267 modified epoxy binder at a minimum rate of 13 lbs/sy and at a saturation
268 state where no wet spots appear. Ensure leveling of HFST liquid is not
269 disturbed. Ensure that the aggregate distribution method leaves no
270 holidays in the aggregate distribution pattern spread and has a uniform
271 look to it. The aggregate application shall cover the entire area of the
272 binder application. Check thickness of HFST liquid using a mil gauge every
273 50 linear feet.

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275 **2. Mechanical mixing and application.** Apply the binder by a truck
276 mounted application machine. The binder must be applied onto the
277 pavement section to be treated across the entire lane width and at a
278 uniform compliant application thickness. Do not allow the epoxy base
279 binder material to separate in the mixing lines, cure, dry, or otherwise
280 impair retention bonding or depth of the high friction surfacing aggregate.
281 Apply the mixed components mechanically onto the prepared pavement
282 surface with a uniform thickness of 60 mil +/- 5 mils onto the pavement
283 surface. Within 2 minutes of the binder being applied, mechanically spread
284 the high friction surfacing aggregate onto the installed binder, at a minimum
285 rate of 13 lbs/sy coverage across the full lane width in a uniform continuous
286 application and until saturation such that no wet spots appear. Ensure that
287 the aggregate distribution method leaves no holidays in the aggregate
288 distribution pattern spread and has a uniform look to it. Aggregate
289 application shall cover the entire area of the epoxy binder application
290 without disturbing the leveling of HFST liquid. Check thickness of HFST
291 liquid using a mil gauge every 50 linear feet.

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294 **3. For either method hand or mechanical,** Do not compact
295 aggregate after placement. Completely cover the wet epoxy binder with
296 aggregate to achieve a uniform surface. No exposed wet spots shall be
297 visible once the aggregate is placed. Wet spots indicate insufficient
298 aggregate being applied; if wet spots are present, add more aggregate to
299 the wet spot immediately upon discovery.

300
301 Check thickness of epoxy base binder every 50 linear feet using a mil
302 gauge.

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304 **(D) Curing.** Allow the high friction surface treatment to cure in
305 accordance with the manufacturer recommendations. Refer to

306 Manufacturer's data/charts for cure times vs temperature. Protect treated
307 surfaces from traffic and environmental effects until the area has cured.
308 The new HFST area must not be open to traffic until it has cured and swept
309 clean of all loose HFST aggregate.

310
311 Once cured, remove excess aggregate by mechanical broom,
312 mechanical sweeper with a vacuum followed by compressed air (minimum
313 185 cfm compressor) before opening to traffic. Excess aggregate can be
314 reused for one reuse time only, provided the aggregate is kept clean, dry
315 and free from contaminants. Recovered aggregate must be blended with
316 new aggregate at a rate of 2:1 (two parts of new HFST aggregate to one
317 part of recovered HFST aggregate). Remove and dispose excess
318 aggregate from project site.

319
320 The Engineer may require additional mechanical broom, sweep or
321 vacuum as necessary after the system fully cures and the treated surface
322 is open to traffic. Broom or vacuum immediately before opening to traffic
323 and perform a final sweep 7 to 14 days after opening. Provide traffic control
324 during the cleaning operation.

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326 **(E) Pavement Markings.** All pavement markings shall be at the height
327 specified in the Contract Documents measured from the HFST surface.
328 Temporary pavement markings must comply with the size and shape
329 shown in the MUTCD and must be in place before the pavement is open
330 to public traffic. Flexible temporary raised pavement markers must not be
331 used in place of raised markers that are shown on Standard Plans TE-26.

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333 **(F) Additional Signs.** Install traffic warning signage "Loose Gravel",
334 and "Motorcycles Use Caution" or both should conditions require the
335 warning. Maintain signs until street sweep is no longer required by the
336 Contract Document and the Engineer.

337 **(G) Acceptance and Warranty.** Ninety (90) days after construction is
338 completed all HFST applications require a minimum 1.5-year warranty from
339 surface defects. At the end of the warranty period, the Contractor must in
340 the presence of the Engineer inspect for any surface defects attributable
341 to materials, equipment or workmanship. The warranty will comply with
342 Subsection 108.17 Guarantee of Work.

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344 **421.04 Measurement.** The quantities to be paid for will be the plan quantity, in
345 square yards, completed and accepted. No deduction will be made for the areas
346 occupied by manholes, inlets, drainage structures, pavement markings or by any
347 public utility appurtenances within the area.

348
349 **421.05 Payment.** The Engineer will pay for the accepted high friction surface
350 treatment at the contract price per square yard as shown on the proposal schedule.
351 All work will be full compensation for the work prescribed in this section and the
352 contract documents.

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The Engineer will pay for the following pay item when included in proposal schedule:

Pay Item	Pay Unit
High Friction Surface Treatment	Square Yard

END OF SECTION 421