CITY OF NOVI CITY COUNCIL
JUNE 7, 2021

SUBJECT: Consideration of approval of Change Order No. 2 to Pro-Line Asphalt Paving Corporation for the 2021 Neighborhood Road Program – Asphalt Streets, in the amount of $661,180.44.

SUBMITTING DEPARTMENT: Department of Public Works, Engineering Division

EXPENDITURE REQUIRED	**$ 661,180.44**
AMOUNT BUDGETED	**$ 2,287,187.00**
APPROPRIATION REQUIRED	**$ 0**
LINE ITEM NUMBER	**203-203.00-864.223**

BACKGROUND INFORMATION: OHM-Advisors assisted the DPW Engineering Division with developing a list of potential streets for the 2020 and 2021 Neighborhood Road Program (NRP). The program was divided into two contracts: concrete roads and asphalt roads. The programs were also advertised for a two-year contract to secure unit prices and lower the overall costs of bidding and design.

In order to design a proper pavement cross section, the civil engineer and geotechnical engineer always obtain pavement cores and soil borings of the existing roadway. These cores and borings provide information on the properties of the underlying soils (i.e., sand, silt, clay, hard, stiff, dense, loose, etc.), moisture content, dry density, permeability, pavement thickness, and pavement compaction. With these known variables, they can determine the best means, methods, and materials used by a contractor to build a long-lasting roadway system.

The City's geotechnical engineering consultant, Testing Engineers & Consultants, Inc. (TEC) performed a minimum of two pavement cores and soil borings per street in the Orchard Ridge Subdivision. The results yielded that although high-moisture clay soils were found, they were dense enough to support a foundation of base stone. The samples also determined that a variable depth of existing asphalt millings was found on top of the clay soils providing a good layer of foundation that could fully or partially remain in place. Finally, the samples revealed a healthy cross section of existing asphalt pavement (6 to 8 inches thick).

Therefore, TEC developed a cross section that included placing a geogrid directly on the asphalt millings to stabilize them and minimize their vertical movement. Then, placing a relatively thin layer (4-inches) of aggregate stone to increase the structural integrity of the foundation. Finally, it was recommended to place 4-inches of MDOT-certified asphalt mix on top of that.

Upon removal of the existing asphalt, it was quickly determined that a totally different pavement cross section was evident. The original developer for the Orchard Ridge Subdivision appeared to have not only paved directly on clay soils (which was an acceptable pavement cross section in the late 1970s and early 1980s), but also paved between 12-inches and 16-inches of asphalt at a time in one lift with substandard asphaltic binder and little to no compaction.

The excessively thick, sandy mix of asphalt disintegrated from the bottom-up. So, what was thought to be a layer of asphalt millings was actually an open-graded, poorly compacted layer of asphalt, yielding no structural integrity to the layers of asphalt above it. The conditions found above are described in more detail with the attached "Discussion of Unforeseen Pavement and Subgrade Soil Conditions" letter by TEC (dated May 22, 2021).

This mix of disintegrated asphalt and moist clays will now be required to be completely removed. Which means this 12-inch to 16-inch void will need to be rebuilt with a new section of geogrid, 10-inches of aggregate stone base and 6-inches of asphalt pavement thickness in order to properly bridge the underlying clay soils.

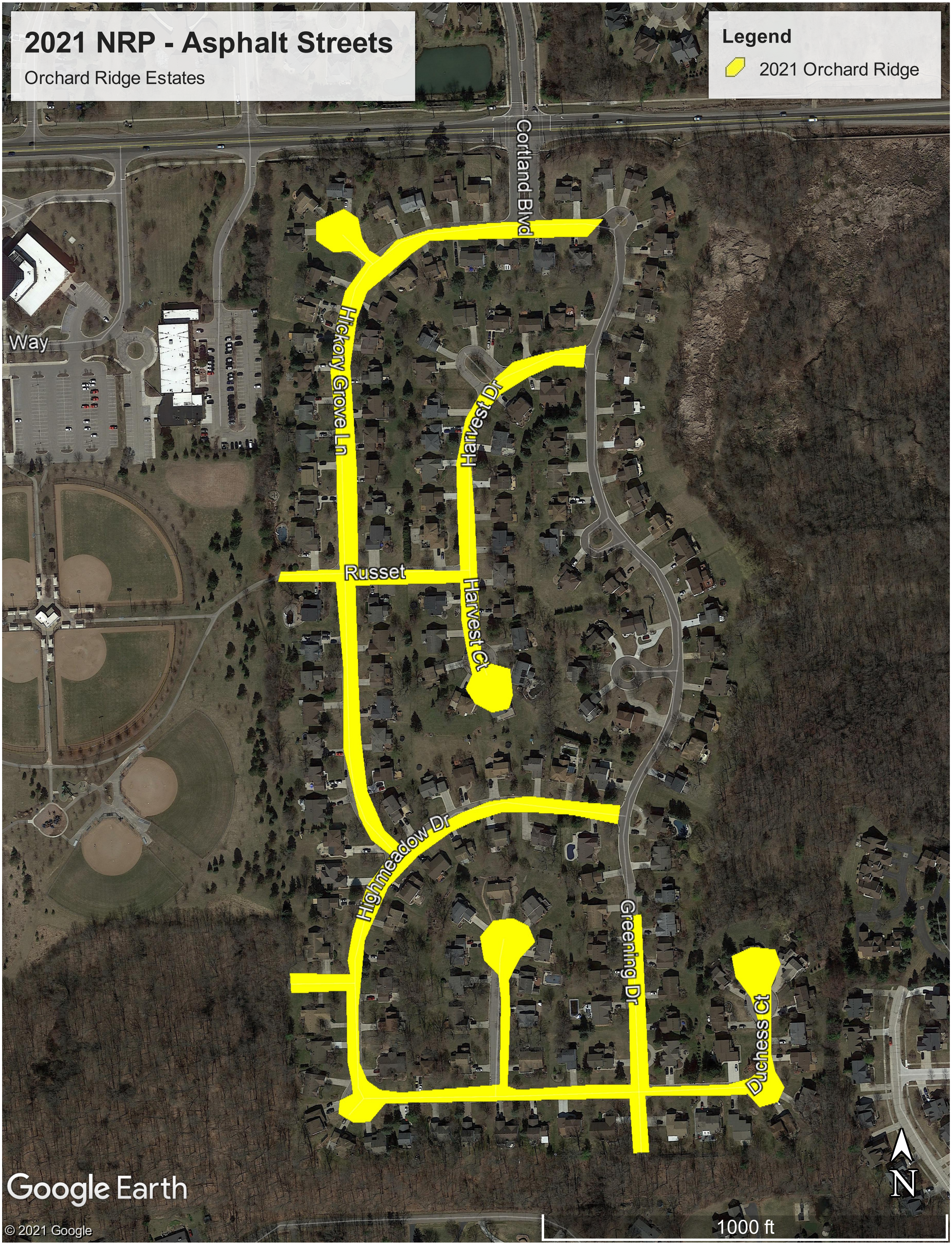
The contract administration and geotechnical engineering services related to this project change order will be granted to the following pre-qualified firms using the fee percentages in the Agreements for Professional Engineering Services and Geotechnical Engineering Services for Public Projects.

OHM-Advisors			
Orchard Ridge Revised Road Cross Section	Contract Administration	4.75% of the construction contract ($661,180.44 X 0.0475)	$ 31,406.07
	Crew Days	$700 daily inspection fee x 40 days	$ 28,000.00
Testing Engineers & Consultants, Inc. (TEC)			
Orchard Ridge Revised Road Cross Section	Material testing services	1.9% of the construction contract ($661,180.44 X 0.019)	$ 12,562.43

ACTION: Approval of Change Order No. 1 to Pro-Line Asphalt Paving Corporation for the 2021 Neighborhood Road Program – Asphalt Streets, in the amount of $661,180.44.

2021 NRP - Asphalt Streets

Orchard Ridge Estates



WORK CHANGE DIRECTIVE & CHANGE ORDER No. 2

PURCHASE ORDER NO. 96545

NOVI NO.: 21-2101
CIP NO.: 102-01

Project: 2021 NRP - Asphalt Streets

Owner: City of Novi
26300 Lee BeGole Dr.
Novi, Michigan 48375
(248) 735-5632

Engineer: OHM Advisors
34000 Plymouth Road
Livonia, Michigan 48150
(734) 522-6711

Contractor: Pro-Line Asphalt Paving Corp.
11797 29 Mile Road
Washington, Michigan 48095
(586) 752-7730

This document hereby renders changes in the Work, changes in the Contract Time and changes in the Contract Price by adding, deducting and/or balancing individual Contract line items through a signed authorization of the Prime Contractor, Owner, and Engineer.

Drafted Date: May 25, 2021

Reasoning: This WCD/CO was necessary due to recommendations from the geotechnical consultant to increase the existing plan cross section from a 4" HMA over 4" Aggregate section to a 6" HMA over a 10" Aggregate section. This change was deemed necessary to construct a long lasting road system as site conditions differed from the original geotechingal report.

EXISTING CONTRACT ITEMS

Item No.	Division	Item Description	Unit	Unit Price	Quantity	Contract Price Add	Contract Price Deduct
0		"Crew Days" - Base Bid	CD	$700.00	40	☑	☐
0		"Crew Days" -	CD	$700.00		☐	☐
0		"Crew Days" -	CD	$700.00		☐	☐
0		"Crew Days" -	CD	$700.00		☐	☐
0		"Crew Days" -	CD	$700.00		☐	☐
7	1	7A_Aggregate Base, 4-inch, Alternate	SYD	$10.50	25358		$266,259.00
16	1	HMA, 4E1	TON	$110.00	2080		$228,800.00
17	1	17A_HMA, 5E1, Fiber Added	TON	$126.00	2398		$302,148.00
					Subtotals	$0.00	$797,207.00
					Total		-$797,207.00

NEW CONTRACT ITEMS

Item No.	Division	Item Description	Unit	Unit Price	Quantity	Contract Price Add	Contract Price Deduct
32	1	Aggregate Base, 8-inch, Modified	SYD	$18.00	5238.08	$94,285.44	
37	1	HMA, 5E1	TON	$121.00	2862	$346,302.00	
38	1	HMA, 2C	TON	$130.00	3960	$514,800.00	
39	1	Aggregate Base, 10-inch, Modified	SYD	$25.00	20120	$503,000.00	
					Subtotals	$1,458,387.44	$0.00
					Total		$1,458,387.44

Increase/Decrease in Contract Price	$661,180.44
Original Contract Amount	$1,926,401.20
Sum of Previous Approved Change Orders	$1,070,965.00
Revised Contract Amount	$3,658,546.64

THE CHANGES ADDRESSED BY THIS CHANGE ORDER HEREBY ADJUSTS THE CONTRACT TIME BY: ______

Accepted By: ______________________________
Pro-Line Asphalt Paving Corp.

Prepared By: ______________________________
OHM Advisors

Reviewed By: ______________________________
Aaron J. Staup, Construction Engineer

Approved By: ______________________________
Tracey Marzonie, Purchasing Manager

Testing Engineers & Consultants, Inc.
1343 Rochester Road • PO Box 249 • Troy, Michigan 48099-0249
(248) 588-6200 or (313) T-E-S-T-I-N-G
Fax (248) 588-6232

Engineering Client Success

TEC Report Number: 61419-009 enm
Date Issued: May 22, 2021

Mr. Aaron Staup
City of Novi
26300 Lee BeGole Drive
Novi, Michigan 48375

**Re: Discussion of Unforeseen Pavement and Subgrade Soil Conditions
2020/2021 Neighborhood Road Program – HMA Streets
City of Novi, Michigan**

Dear Mr. Staup:

Testing Engineers and Consultants, Inc. (TEC) has been providing ongoing geotechnical and construction materials consultation services to support the 2020/2021 Neighborhood Road Program – HMA Streets project the City of Novi, Michigan.

During the geotechnical investigation of the routes included in the Orchard Ridge Estates subdivision, observations from the pavement core and subgrade soil sampling indicated that the pavements were predominantly constructed with hot mix asphalt (HMA) in varying thickness, supported by a base course consistent with recycled / pulverized asphalt on underlying clay subgrade soils. Full depth HMA placed directly on the clay subgrade soils was also noted at a few locations, but the section with the base course was predominantly noted.

Background

The performance of HMA pavements with base courses is far superior to the performance of pavements placed directly on the clay subgrade soils. The base course provides better pavement support, provides better subsurface drainage, and allows for more precise grade control during construction. The improved subsurface drainage allows for infiltration water to be directed away from the roadway, rather than soaking into the HMA and underlying soils., HMA pavements build using this methodology have more available options for preventative maintenance and rehabilitation during their service lives.

HMA pavements installed directly on clay subgrade soils have poor drainage characteristics. Precipitation and adjacent irrigation throughout the pavement service life exposes the pavement and subgrade soils to infiltration water. When the infiltration water is not readily drained away, the moisture accumulation deteriorates the lower portion of the HMA pavement on an ongoing basis and causes the clay soils increasingly soften as additional water is absorbed.

In this situation, the pavement deterioration begins at the bottom and continues toward the surface throughout the pavement service life, as opposed to cracks that form at the surface and extend deeper over time. This is colloquially referred to as a "bottom → up" type of pavement failure.

The costs of pavement rehabilitation or reconstruction of these types of pavements (poorly drained, bottom→up failure) are significantly greater than well drained pavements. The softened subgrade soils are unsuitable for support of new pavements or the construction operation itself. This necessitates costly improvements such as removal of the soft clay soils and replacement with engineered fill and geosynthetic reinforcements.

Unforeseen Pavement and Subgrade Soil Conditions

During pavement removal in Orchard Ridge Estates, the actual HMA pavement and base thickness have been significantly different than the samples collected during the geotechnical investigation suggested. A full depth HMA pavement directly placed on the clay subgrade soils has been encountered, and the observed softening of the clay subgrade soils has been consistent with the anticipated effects of this type of pavement system.

The bottom portion of the full depth existing HMA pavement (the portion that presented itself as pulverized / recycled HMA base) is actually a relatively fine-textured asphalt mix of some type. During removal operations, the bottom portion of the pavement visually appears to be intact, but it rapidly disintegrates to the consistency of pulverized / recycled HMA with minimal force or agitation, such as with manipulation by human hands or impacted by hand tools. The diamond-tipped core drill likely disintegrated this material instantaneously during the sample collection of the geotechnical investigation.

The lower layer of full depth HMA pavements is traditionally paved with HMA mixes that utilize relatively large gravel for additional strength. The lower layer of the pavements in Orchard Ridge Estates is a relatively fine textured mix that is consistent with the mix used for the surface layer. The rapid disintegration with minimal effort is consistent with a relatively low asphalt cement content. Asphalt cement is the glue that binds the particles together in HMA mixes.

It is possible that during initial pavement construction in Orchard Ridge Estates, a relatively low-strength HMA mix was installed on the unimproved clay subgrade soils, in an attempt to 'bridge' over the soils to create a more suitable surface upon which to install the remainder of the pavement. While this is atypical of traditional HMA pavement construction, this methodology is consistent with concrete construction, where a non-structural lean concrete 'mud mat' is often installed over wet or soft soils to provide a suitable surface upon which to install forms, reinforcing steel, etc.

If the above-described pavement and subgrade soil conditions were apparent during the geotechnical investigation, pavement construction recommendations would have included large-scale removal of the upper clay subgrade soils and installation of crushed aggregate fill with geosynthetic reinforcement prior to aggregate base course installation. The costs of this type of methodology would be significant.

Alternate Pavement Construction Methodology

The alternate pavement construction methodology described herein is intended to allow for pavement construction based on the additional information available, while minimizing the additional costs and time required. This type of methodology has been successfully implemented for similar situations in this area. The methodology is outlined below:

- Removal of the entire pavement and subgrade soils to a depth of the entire existing pavement thickness or 16 inches below the top of pavement elevation, whichever is greater;
- Installation of multiaxial geogrid reinforcement, TriAx 130S, prior to aggregate base course installation;
- Installation of MDOT 21AA dense graded aggregate base course, 10 inch compacted thickness. If the existing pavement thickness necessitates removal beyond 16 inches, the aggregate base course thickness should be increased accordingly;
- Substitution of HMA mixture 2C as the leveling course, instead of HMA mixture 4E1. Mixture 2C has larger crushed gravel for additional strength, which is better suited for thicker application over softer subsoils;
- Installation of the HMA 2C leveling course in a single layer, with 4 inch compacted thickness. If cracking in the leveling course is observed during compaction prior to achieving the specified density, the compaction in that area should be halted to avoid pavement damage;
- Installation of the top course with HMA mixture 5E1, 2 inches thick, in accordance with the project plans.

Installation of the HMA 2C in a 4-inch compacted layer is compliant with the minimum and maximum application rates promulgated by MDOT. These minimum and maximum application rates dictate that 4 inches of HMA 4E1 would require installation in 2 layers. Additional construction traffic associated with the delivery, placement and compaction of the additional layer will likely induce additional damage to the underlying soils and/or damage the initial layer of leveling course.

It is likely that localized extremely soft areas will be exposed during pavement removal that necessitate additional improvements beyond what is described above. If encountered, these localized areas should be evaluated on a case-by-case basis and improved as necessary using the as-directed undercut and backfill methods included in the contract.

Available Potential Cost Savings

It may be possible to mitigate some of the costs associated with the methodology described above by not selecting some of the Alternate Items in the contract. Alternate items in the contract include: Addition of aramid synthetic fiber reinforcement to the HMA top course; and use of J-Band Void Reducing Asphalt Membrane to longitudinal paving joints.

Addition of synthetic fiber reinforcement to the asphalt top course and the use of Void Reducing Asphalt Membrane along longitudinal joints are relatively new technologies. TEC understands that City of Novi intended to use these Alternate Items to observe their impacts to pavement durability and maintenance requirements throughout the service life relative to the cost. Successful completion of the project is possible at a slightly lower cost without the inclusion of these Alternate items.

Closure

TEC appreciates the opportunity to continue providing professional services to the City of Novi. If you have any questions, or require any additional information, please contact the undersigned at your convenience.

Respectfully submitted,

TESTING ENGINEERS & CONSULTANTS, INC.

William West

William J. West, PE
Manager, Construction Services