



## Paint Analysis Test No. 15-545 Summary Report

This test was sent to 123 participants. Each sample set consisted of one item containing a "known" paint sample and two items containing "questioned" paint chips. Participants were requested to compare the items and report their findings. Data were returned from 107 participants (87.0% response rate) and are compiled into the following tables:

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This report contains the data received from the participants in this test. Since these participants are located in many countries around the world, and it is their option how the samples are to be used (e.g., training exercise, known or blind proficiency testing, research and development of new techniques, etc.), the results compiled in the Summary Report are not intended to be an overview of the quality of work performed in the profession and cannot be interpreted as such. The Summary Comments are included for the benefit of participants to assist with maintaining or enhancing the quality of their results. These comments are not intended to reflect the general state of the art within the profession.

Participant results are reported using a randomly assigned "WebCode". This code maintains participant's anonymity, provides linking of the various report sections, and will change with every report.

# Manufacturer's Information

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Each sample set contained three items consisting of automotive paint samples. Item 1 was a known paint sample representative of the damaged area of the suspect vehicle. Items 2 and 3 were sets of questioned paint chips recovered from the street lamp and the mailbox, respectively. Participants were requested to examine the questioned paint chips and determine if any could have originated from the damaged area of the suspect's vehicle.

The paint samples in Items 1 and 3 were prepared from the same automotive paint panel obtained from ACT Test Panels. The test panel was described as a gray coil coated aluminum substrate panel with a solvent borne primer, gray basecoat, and clearcoat. The panel which made up Item 2 was made with the same basecoat and clearcoat, but contained a powder primer.

## SAMPLE PREPARATION-

The panels used for this test were inspected for defects, and the areas where defects were located were not used.

ITEM 2 (ELIMINATION): For Item 2, the paint panel was cut into approximately  $\frac{1}{4}$ " x  $\frac{1}{4}$ " wide pieces using tin snips. Two of these pieces were packaged into a glassine bag and then a pre-labeled Item 2 coin envelope. Item 2 was packaged into the sample pack as described below.

ITEMS 1 and 3 (IDENTIFICATION): For the known Item 1, the appropriate paint panel was cut into approximately  $\frac{1}{2}$ " x  $\frac{1}{2}$ " wide pieces using tin snips and one piece was packaged into a glassine bag and a pre-labeled Item 1 coin envelope. For the matching Item 3 samples, paint chips were cut into approximately  $\frac{1}{4}$ " x  $\frac{1}{4}$ " wide pieces using tin snips. Two of these pieces were packaged into a glassine bag and then a pre-labeled coin envelope for Item 3. This process was repeated until all of the Items were created. Items 1 and 3 were taken in close spatial proximity to one another, within four inches, and were kept together as an identification group and packaged into the sample pack as described below.

SAMPLE SET ASSEMBLY: For each sample set, Items 1, 2, and 3 were placed in a pre-labeled envelope. The sample pack was sealed with invisible tape. This process was repeated until all of the sample sets were prepared. Once verification was completed, all sample packs were further sealed with a piece of evidence tape and initialed "CTS".

## VERIFICATION-

The expected association and elimination results were confirmed by predistribution laboratories who used the following combined list of techniques: Stereomicroscopy, polarized light, fluorescence, FTIR, and SEM/EDX.

## **Summary Comments**

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This test was designed to allow participants to assess their proficiency in the examination, comparison and interpretation of multi-layered automotive paint samples. Each test sample set consisted of one item containing a known sample (Item 1) and two items containing questioned chips (Items 2 and 3). The paint samples in Items 1 and 3 were cut from the same automotive panel. Item 2 was cut from a different automotive panel (Refer to Manufacturer's Information for preparation details.)

Of the 107 participants that reported results in Table 1, 106 (99.1%) reported that the questioned paint chips in Item 2 could not have originated from the same source as the known paint sample in Item 1. The remaining participant reported that the questioned paint chips in Item 2 could have originated from the same source as the Item 1 known paint sample. Of the 107 participants, 104 (97.2%) reported that the questioned paint chips in Item 3 could have originated from the same source as the known paint sample in Item 1. Of the remaining participants, two reported that the questioned paint chips in Item 3 could not have originated from the same source as the known paint sample in Item 1 and one participant reported inconclusive results.

# Examination Results

Could the questioned paint chips (Items 2 and/or 3) have originated from the damaged area of the suspect vehicle represented by Item 1?

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
23TGMH	No	Yes	BU63CA	No	Yes
2AQDYM	No	Yes	CH6U9X	No	Yes
2LJPHT	No	Yes	CMK89K	No	Yes
2R98XP	No	Yes	CT8YC8	No	Yes
36B3LJ	No	Yes	CUX36E	No	Yes
3EW9JM	No	Yes	CYQHDM	No	Yes
4ZUCJL	No	Yes	D3BR3D	No	Yes
6BB7NM	No	Yes	D9YAJB	No	Yes
6GWC6U	No	Yes	D9YC9E	No	Yes
6LEAZC	No	Yes	DGPUN9	No	Yes
6RZH7N	No	Yes	DQDNYK	No	Yes
6XZTA8	No	No	DR7NUA	No	Yes
72ZEHP	No	Yes	DVB6DY	No	Yes
7FGCNQ	No	Yes	E9BCJF	No	Yes
7VCRP6	No	Yes	EDAJB6	No	Yes
8NQ3HG	No	Yes	ER8VJ9	No	Yes
8WLYQC	No	Yes	FBDN22	No	Yes
8WZPEM	No	Yes	FEXFBH	No	Yes
9GQVMD	No	Yes	FJM2XB	No	Yes
9KHA2M	No	Yes	FR3TAU	No	Yes
9WF4KC	No	Yes	FUAZQ2	No	Yes
AFRDHX	No	Yes	FVH4KD	No	Yes
AJNYR7	No	Yes	G32UKD	No	Yes
AKHKJB	No	Yes	GCJFL2	No	Yes
ALD9YL	No	Yes	GEV8JB	No	Yes
ALWY3E	No	Yes	GHUJHV	No	Yes
AX398F	No	Yes	GTDVT9	No	Yes
BFZQWB	No	Yes	H87WYE	No	Yes
BLQ4WD	No	Yes	HNC9EB	No	Yes
BQYLV7	No	Yes	HXH3P3	No	Inc

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
KFTW72	No	Yes	XKF37W	No	Yes
KLZDN3	No	Yes	Y2H2UQ	No	Yes
KUEZYR	No	Yes	Y4DD2D	No	Yes
L4W2UR	No	Yes	YC44CL	No	Yes
M3F7PC	No	Yes	YGVDLK	No	No
MLUHH3	No	Yes	YHPYDQ	No	Yes
MM36K9	No	Yes	YM6MXM	No	Yes
MTT8Y7	No	Yes	Z7AQPN	Yes	Yes
MWV9Y4	No	Yes	ZCY97K	No	Yes
MYZTNN	No	Yes	ZGEJJP	No	Yes
N3WN2W	No	Yes	ZKU2MR	No	Yes
N6GQR3	No	Yes	ZMHBXE	No	Yes
NMHC UW	No	Yes	ZNAG9D	No	Yes
PYVQX	No	Yes	ZUGZDX	No	Yes
RBDM4X	No	Yes			
RUNKL9	No	Yes			
RZGLP9	No	Yes			
TL7DE4	No	Yes			
TQKALQ	No	Yes			
UE77H2	No	Yes			
UX2Y4Y	No	Yes			
UYB9WW	No	Yes			
VNULMV	No	Yes			
W28F8K	No	Yes			
W332XP	No	Yes			
W7338Z	No	Yes			
W8V43P	No	Yes			
WBX2BW	No	Yes			
WE2PZK	No	Yes			
WEY8RN	No	Yes			
WKLQFX	No	Yes			
WWGYYZ	No	Yes			
X99XHP	No	Yes			

  

Response Summary			
		Item 2	Item 3
Responses	Yes	<b>1</b> (0.9%)	<b>104</b> (97.2%)
	No	<b>106</b> (99.1%)	<b>2</b> (1.9%)
	Inc	<b>0</b> (0%)	<b>1</b> (0.9%)
Participants: 107			

# Examination Methods

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTR	Solubility/ Chemical	XRF/XRF	SEM/EDX	Microspectrophotometry	Other
23TGMH	✓			✓	✓					
2AQDYM	✓	✓	✓		✓					
2LJPHT	✓			✓	✓	✓		✓		
2R98XP	✓		✓		✓			✓		
36B3LJ	✓				✓					
3EW9JM	✓				✓			✓		
4ZUCJL	✓				✓					
6BB7NM	✓				✓	✓				
6GWC6U	✓	✓	✓		✓			✓		
6LEAZC	✓	✓	✓		✓			✓	✓	
6RZH7N	✓				✓			✓		
6XZTA8	✓		✓		✓			✓		
72ZEHP	✓				✓			✓		
7FGCNQ	✓		✓	✓	✓	✓				
7VCRP6	✓	✓	✓		✓	✓	✓			Raman spectroscopy
8NQ3HG	✓	✓			✓					
8WLYQC	✓				✓			✓		
8WZPEM	✓				✓	✓				
9GQVMD	✓		✓		✓	✓		✓		
9KHA2M	✓		✓		✓	✓				
9WF4KC	✓		✓		✓			✓		
AFRDXH	✓	✓			✓	✓	✓			Pyrolysis GC/MS
AJNYR7	✓	✓	✓		✓			✓	✓	
AKHKJB	✓			✓	✓	✓				Cross-sections
ALD9YL	✓			✓	✓			✓		

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTR	Solubility/ Chemical	XRF/XRF	SEM/EDX	Microspectrophotometry	Other
ALWY3E	✓			✓	✓					
AX398F	✓				✓					
BFZQWB	✓				✓	✓				
BLQ4WD	✓				✓		✓			
BQYL7	✓					✓				
BU63CA	✓				✓			✓		
CH6U9X	✓				✓		✓			
CMK89K	✓	✓			✓			✓	✓	
CT8YC8	✓				✓					
CUX36E	✓					✓				Magnifying Glass.
CYQHDM	✓	✓	✓	✓	✓			✓	✓	Raman
D3BR3D	✓	✓			✓				✓	Comparison Microscope
D9YAJB	✓	✓			✓			✓		
D9YC9E	✓			✓	✓			✓		
DGPUN9	✓				✓		✓		✓	
DQDNYK	✓			✓	✓			✓		
DR7NUA	✓				✓			✓		
DVB6DY	✓	✓		✓	✓					
E9BCJF	✓	✓	✓		✓			✓		
EDAJB6	✓				✓			✓		RAMAN
ER8VJ9	✓				✓	✓		✓		
FBDN22	✓	✓	✓		✓			✓	✓	
FEXFBH	✓	✓	✓		✓			✓		Pyrolysis GCMS
FJM2XB	✓				✓	✓				
FR3TAU	✓	✓	✓		✓					
FUAZQ2	✓				✓					
FVH4KD	✓		✓	✓	✓	✓				

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTR	Solubility/ Chemical	XRS/XRF	SEM/EDX	Microspectrophotometry	Other
G32UKD	✓				✓			✓		
GCJFL2	✓		✓		✓					
GEV8JB	✓	✓			✓			✓		
GHUJHV	✓				✓			✓		Pyrolysis GC/MS
GTDVT9	✓			✓	✓					high power microscopy
H87WYE	✓				✓		✓			
HNC9EB	✓			✓	✓	✓		✓		Comparison Microscope
HXH3P3	✓				✓			✓		
KFTW72	✓	✓			✓			✓		
KLZDN3	✓	✓			✓			✓		
KUEZYR	✓	✓		✓	✓			✓	✓	
L4W2UR	✓			✓	✓			✓		
M3F7PC	✓				✓			✓		
MLUHH3	✓	✓			✓	✓		✓		
MM36K9	✓	✓	✓		✓			✓		
MTT8Y7	✓				✓					
MWV9Y4	✓				✓					Comparison Compound Microscopy
MYZTNN	✓				✓			✓		Raman Spectroscopy
N3WN2W	✓				✓			✓		
N6GQR3	✓				✓			✓		UV
NMHCUW	✓		✓		✓		✓			
PYVVQX	✓	✓	✓	✓	✓			✓		
RBDM4X	✓	✓			✓			✓	✓	Microtome
RUNKL9	✓	✓		✓	✓	✓	✓	✓		
RZGLP9	✓	✓		✓	✓	✓		✓		
TL7DE4	✓	✓	✓		✓			✓		



TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTR	Solubility/ Chemical	XRS/XRF	SEM/EDX	Microspectrophotometry	Other
TQKALQ	✓				✓					
UE77H2	✓				✓		✓			
UX2Y4Y	✓	✓			✓	✓		✓		Pyrolysis GC/MS
UYB9WW	✓	✓		✓	✓			✓		
VNULMV	✓			✓	✓	✓		✓	✓	
W28F8K	✓		✓		✓			✓		
W332XP	✓				✓					
W7338Z	✓				✓			✓		Raman Spectroscopy
W8V43P	✓				✓			✓		
WBX2BW	✓			✓	✓			✓		
WE2PZK	✓				✓			✓		
WEY8RN	✓	✓			✓			✓		
WKLQFX	✓				✓			✓		
WWGYYZ	✓	✓			✓			✓		comparison polarized light microscope
X99XHP	✓				✓					
XKF37W	✓				✓		✓			
Y2H2UQ	✓				✓	✓				
Y4DD2D	✓		✓		✓			✓		Raman spectroscopy
YC44CL	✓				✓					
YGVDLK	✓				✓	✓				Binnocular[sic] light microscope
YHPYDQ	✓				✓					
YM6MXM	✓	✓		✓	✓	✓				
Z7AQPN	✓				✓					
ZCY97K	✓				✓	✓				
ZGEJJP	✓				✓	✓				
ZKU2MR	✓				✓	✓		✓		

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	XRS/XRF	SEM/EDX	Microspectrophotometry	Other
ZMHBXE	✓	✓		✓	✓			✓		
ZNAG9D	✓				✓	✓				
ZUGZDX	✓				✓			✓		

Response Summary										
	Participants	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	XRS/XRF	SEM/EDX	Microspectrophotometry
	107	107	33	24	23	105	24	12	62	10
Percent	100%	31%	22%	21%	98%	22%	11%	58%	9%	

# Conclusions

TABLE 3

WebCode	Conclusions
23TGMH	The known paint sample (Item 1) and the questioned paint chips (Item 3) are each composed of four paint layers. Each of the four layers in the known paint sample (Item 1) cannot be distinguished from the corresponding layers in the questioned paint chips (Item 3). The questioned paint chips recovered from the mailbox (Item 3) could have come from the damaged area of suspect vehicle (Item 1). The questioned paint chip (Item 2) is composed of four paint layers. However both undercoat layers are distinguishable from both undercoat layers in the known paint sample (Item 1). Therefore the questioned paint chip recovered from street lamp (Item 2) could not have come from the damaged area of suspect vehicle (Item 1).
2AQDYM	In my opinion, my findings provide very strong support for the proposition that paint chips in item 3 originated from the damaged area of the suspect vehicle. No match was found between item 2 and the submitted sample from the damaged area of the suspect vehicle.
2LJPHT	Examination of Items #1, 2, & 3 revealed the presence of gold paint chips with reflective flake and the following layer structure: Clear, Gold with Reflective Flake, Light Gray, & Dark Gray. The gold paint chips collected from the mailbox (Item #3) were found to be physically and chemically consistent with the gold paint chip collected from the damaged area of the suspect vehicle (Item #1). Therefore, the gold paint chips from Item #3 could have originated from the same source as gold paint chip from Item #1. The gold paint chips collected from the street lamp (Item #2) were not chemically consistent with the gold paint chip collected from the damaged area of the suspect vehicle (Item #1). Therefore, the gold paint chips from Item #2 could not have originated from the same source as gold paint chip from Item #1.
2R98XP	The paint evidence in Item 3 (from mailbox) is four layer, silver metallic automotive paint that is similar in layer color, layer sequence, and layer chemistry to the paint evidence from Item 1 (damaged area of suspect vehicle). Item 3 could have originated from the same source as Item 1 or from another paint source with similar paint. The paint evidence in Item 2 (from street lamp) is four layer, silver metallic automotive paint that is similar in color and layer sequence, but different in chemistry when compared with the paint evidence from Item 1 (damaged area of suspect vehicle). The paint evidence in Item 2 (from street lamp) could not have originated from the same source as Item 1 (damaged area of suspect vehicle). Chemical analysis performed on Items 1, 2, and 3 includes: Fourier-Transform Infrared Spectroscopy (FT-IR) and Scanning Electron Microscopy - Energy Dispersive X-ray Spectroscopy (SEM-EDS).
36B3LJ	The FTIR examination resulted in that all spectra generated from (item 3) layers showed an accepted high match with their corresponding spectra generated from (item 1) layers, while those spectra generated from (item 2) layers showed no accepted match with their corresponding spectra generated from (item 1) layers. Therefore, item 3 could have come from the same source as item 1 is from (damaged area on the car).
3EW9JM	Base coats (primers) of samples 1 and 2 were different and therefore could not be from the same source. No differences were observed between samples 1 and 3. Sample 3 could have originated from the suspect vehicle.
4ZUCJL	The known paint sample (Item 1) and the two questioned paint chips (Item 2 and Item 3) consist each of four paint layers. The lower two layers of the known paint sample (Item 1) differ from the lower two layers of the questioned paint chip (Item 2) recovered from the street lamp. Therefore this questioned paint chip (Item 2) cannot have come from the damaged area of the suspect vehicle as represented by Item 1. The four layers of the known paint sample (Item 1) cannot be distinguished from the corresponding layers of the questioned paint chip (Item 3) recovered from the mailbox. Therefore this questioned paint chip (Item 3) could have

TABLE 3

WebCode	Conclusions
	originated from the damaged area of the suspect vehicle as represented by Item 1.
6BB7NM	The questioned paint chip marked as Item 2 is not similar with known paint sample marked as Item 1, while the questioned paint chip marked as Item 3 is similar with Item 1. In my conclusion, the paint chip marked as Item 3 could have originated from the damage area of suspect vehicle.
6GWC6U	1. Comparative examinations of the paint sample in Exhibit 1 (known paint sample representative of the damaged area of suspect vehicle) with the paint chips in Exhibit 3 (questioned paint chips recovered from mailbox) disclosed them to be consistent in their physical characteristics, organic compositions, and elemental compositions. Therefore, the questioned paint chips recovered from the mailbox could have had a common source of origin with the known paint sample representative of the damaged area of the suspect's vehicle. 2. Comparative examinations of the paint samples in Exhibits 1 and 2 (questioned paint chips recovered from street lamp) disclosed them to be dissimilar in their physical characteristics and or/chemical compositions. Therefore, the questioned paint chips recovered from the street lamp did not originate from the known paint sample representative of the damaged area of the suspect's vehicle.
6LEAZC	Samples of the questioned paint in Items 2 and 3 were compared to samples of the known paint in Item 1 using one or more of the following techniques: microscopy, fluorescence, infrared spectroscopy (IR), scanning electron microscopy - energy dispersive spectrometry (SEM-EDS), and microspectrophotometry (MSP). The sampled paint in all three items had a layer system of clear over brown-gray over light gray over dark gray. Due to differences in microscopic appearance and fluorescence, the sampled paints in Items 1 and 2 were discriminated. The damaged portion of the vehicle, as represented by the paint in Item 1, is eliminated as a possible source for the questioned paint collected from the street lamp in item 2 (Elimination/Non-Association). Each layer of paint in Item 3 was found to be consistent in chemistry by IR, elemental composition by SEM-EDS, and microscopic and fluorescence characteristics to each corresponding layer of paint in Item 1. Additionally, the color of the brown-gray layer in Item 3 could not be discriminated from that of the corresponding layer in Item 1. The damaged portion of the vehicle, as represented by the paint in Item 1, is a possible source for the questioned paint collected from the mailbox in Item 3 (Level 3 - Association). Because other vehicles/vehicle parts have been manufactured that would have paint that would also be indistinguishable from the submitted evidence, an individual source cannot be determined.
6RZH7N	Items 1, 2 and 3 each consisted of paint samples with a metallic grey appearance. Examination of the items revealed that each of the paint samples consisted of four layers of paint: a clear topcoat, a metallic grey second layer, a light grey third layer and a grey fourth layer. No significant differences were detected in the appearance, chemical composition and elemental composition of each of the four corresponding layers of the paint "damaged area of suspect vehicle" Item 1 and the paint "recovered from mailbox" Item 3. Therefore, in my opinion, the paint "damaged area of suspect vehicle" Item 1 and the paint "recovered from mailbox" Item 3 could share a common origin. No significant differences were detected in the corresponding top two layers of the paint "damaged area of suspect vehicle" Item 1 and the paint "recovered from street lamp" Item 2. However differences were detected in the chemical composition of the third and fourth layers of these paint samples (i.e. Items 1 and 2). Therefore, in my opinion, the paint "damaged area of suspect vehicle" Item 1 and the paint "recovered from street lamp" Item 2 could not share a common origin.
6XZTA8	Items 2 and 3 do not match Item 1.

TABLE 3

WebCode	Conclusions
72ZEHP	The paint from the damaged area of the car (item 1) was found to consist of a clear top coat, a metallic brown/grey second coat and a grey third coat. The paint chips recovered from the street lamp (item 2) also consisted of a clear top coat, metallic brown/grey second coat and a grey third coat. The grey third coat from the street lamp (item 2) was found to have a different chemical composition to the grey third coat from the paint from the car (item 1) and therefore could not have originated from that source. The paint chips recovered from the mailbox (item 3) were found to consist of a clear top coat, a metallic brown/grey second coat and a grey third coat. The three layers of this paint was found to be indistinguishable in relation to colour, chemical composition and elemental composition from the corresponding three layers from the paint from the car (item 1). Therefore these two samples may share a common origin.
7FGCNQ	The paint chips in Item 2 can be excluded as having originated from the damaged area of the vehicle as represented by Item 1 given the differences noted by fluorescence microscopy and in chemical composition. The paint chips in Item 3 were found to be indistinguishable from the paint chip from the damaged area of the vehicle (Item 1) in terms of colour, appearance, number of layers, elemental and chemical composition. In my opinion the findings provide strong support for the proposition that the paint recovered from the mail box originated from the damaged vehicle. (The evidence scale used is as follows: inconclusive, slight support, support, strong support, very strong support, conclusive. This can be used for both defence and prosecution propositions.
7VCRP6	Item #1 and #3 have the same morphological, chemical, optical features and elemental composition layer by layer. The features of the third layer of item #2 are characteristically different from the features of item #1 and #3.
8NQ3HG	The source of item 1 is excluded as a possible source of item 2, based on class characteristics. The source of item 1 is included as a possible source of item 3, based on class characteristics.
8WLYQC	The questioned paint marked "Item 3" could have originated from the same source as the known control paint marked "Item 1", or another source of paint with similar characteristics. The questioned paint marked "Item 2" did not originate from the same source as the known control paint marked "Item 1".
8WZPEM	* Exhibit 2 (paint recovered from street lamp) is chemically dissimilar to Exhibit 1 (paint from suspect's vehicle) and therefore could not have originated from this source. * Exhibit 3 (paint recovered from mailbox) is visually, chemically, and elementally consistent with Exhibit 1 (paint from suspect's vehicle) and therefore could have originated from this source, or a source painted with the same layer structure exhibiting the same chemical and elemental properties.
9GQVMD	Items 1, 2 and 3 were examined visually and using stereomicroscopy and fluorescence microscopy. Items 1 and 3 were further examined using microsolubility tests, microchemical tests, Fourier Transform Infrared Spectrophotometry (FTIR) and Scanning Electron Microscopy-Energy Dispersive X-Ray Spectrometry (SEM-EDS). The multilayered gray paint particles with decorative flake in Items 1 and 3 were consistent in colors, textures, types, layer sequence, and chemical compositions. It was concluded that the paints in Items 1 and 3 either originated from the same source or different sources painted in the same manner. The multilayered gray paint particles with decorative flake in Item 2 could not be associated with the Item 1 multilayered gray paint with decorative flake due to differences in texture and fluorescence.
9KHA2M	The paint in Item 3 is similar in color, layer structure, solubility, fluorescence and infra-red absorbance spectra to the paint in item 1. Therefore the paint in items 1 & 3 could have originated from the same source. The paint in item 2 is similar in color and layer structure to the paint in item 1, however, it is dissimilar in infra-red absorbance spectra. Therefore the

TABLE 3

WebCode	Conclusions
	paint in items 1 & 2 could not have originated from the same source.
9WF4KC	The paint chips recovered from the street lamp (Item 2) were found to be different from the known paint sample representative of the damaged area of suspect vehicle (Item 1). In opposite to the Item 2, the paint chips recovered from the mailbox (Item 3) showed no differences to the known Item 1. The examined criteria were color of paint layers, fluorescence behavior, elemental composition (SEM/EDX) and chemical properties observed by infrared spectroscopy. Differences in Item 2 compared to Item 1 were found in the fluorescence, the chemical properties (observed by infrared spectroscopy) and the elemental distribution. The clearcoat and the effect coat were indistinguishable for all samples. The result admits the conclusion that the questioned paint chip from the mailbox (Item 3) could have originated from the damaged area of suspect vehicle (Item 1).
AFRDXH	The paints in items 001.01 and 001.03 are alike in layer sequence, layer colors, binder composition and pigment characteristics. Therefore, these paints could share a common origin. While the paints in items 001.01 and 001.02 are similar in layer sequence, the light gray primer layer composition is distinctly different. Therefore these paints did not originate from the same source.
AJNYR7	The known paint chip (Item 1) and one randomly selected questioned paint chip from both Item 2 and Item 3 each had the following layer structure: clear over silver over light gray over dark gray. The selected questioned paint chip from Item 2 and the known paint chip (Item 1) were compared using microscopy and infrared spectroscopy (IR). The light gray layers in Items 1 and 2 and the dark gray layers in Items 1 and 2 were found to be dissimilar by IR; therefore, the tested questioned paint chip from Item 2 and the known paint chip (Item 1) did not originate from the same source (Elimination). The selected questioned paint chip from Item 3 and the known paint chip (Item 1) were compared using microscopy, IR, scanning electron microscopy - energy dispersive spectroscopy, and microspectrophotometry. Each layer of questioned paint (Item 3) was similar in all tests performed to the respective layer of known paint (Item 1). The tested questioned paint chip from Item 3 and the known paint chip (Item 1) could have originated from the same source (Level 3 - Association). Because similar items have been manufactured that would be indistinguishable from the submitted evidence, an individual source cannot be determined.
AKHKJB	Item 2: The recovered automotive paint chips are similar in visual color to the known automotive paint from the suspect vehicle. A portion of the questioned sample was further analyzed and determined to be similar in layer sequence but different in chemical solubilities and paint type from the known automotive paint from the suspect vehicle (Item 1). It is my opinion that the questioned paint did not originate from the suspect vehicle (Category 5). Item 3: The recovered automotive paint chips are similar in visual color to the known automotive paint from the suspect vehicle. A portion of the questioned sample was further analyzed and determined to be similar in layer sequence, chemical solubilities, paint type, and paint composition to the known automotive paint from the suspect vehicle (Item 1). It is my opinion that the questioned paint chips could have come from the suspect vehicle or any other vehicle with similar paint characteristics (Category 2B).
ALD9YL	I formed the opinion based on the techniques used, that the questioned paint chips recovered from the street lamp item 2, were distinguishable to and could not have originated from the damaged area of the suspect vehicle, item 1. I also formed the opinion based on the techniques used, that the questioned paint chips recovered from the mailbox item 3, were indistinguishable to and could have originated from the damaged area of the suspect vehicle, item 1.

TABLE 3

WebCode	Conclusions
ALWY3E	[No conclusions reported].
AX398F	Item 2, the paint chips recovered from the street lamp, could not have originated from the same source as Item 1, paint from damaged area of the suspect vehicle. The paint chips recovered from the mailbox, Item 3, could have originated from the same source as Item 1.
BFZQWB	On analysis, I found that Item 3 was similar to Item 1. Hence, I am of the opinion that the questioned paint chips recovered from mailbox (Item 3) could have originated from the damaged area of suspect vehicle as represented by Item 1.
BLQ4WD	2nd layer and 3rd layer of item 1 is similar with item 3, not item 2 by FTIR.
BQYLV7	Paint chips Item 3 (questioned paint chip) to be similar to paint chip Item 1 (known paint sample) in texture, layers and colour. Hence, I am of the opinion that Item 3 being consistent to have originated from the same source as Item 1. Paint chips Item 2 (questioned paint chip) to be dissimilar to paint chip Item 1. [sic]
BU63CA	Examination of Items 1, 2, and 3 revealed a four-layered paint system consisting of a clearcoat, a metallic beige color coat, a gray primer, and a dark gray primer. Microscopic and instrumental analysis and comparison of Item 2 to Item 1 revealed them to be inconsistent with respect to binder and pigment composition. Therefore, Item 2 could not have come from Item 1. Microscopic and instrumental analysis and comparison of Item 3 to Item 1 revealed them to be consistent with respect to color, texture, type, layering sequence, binder composition and pigment composition. Therefore, Item 3 came from the area of the vehicle represented by Item 1 or another vehicle with the same paint history.
CH6U9X	Results and Opinions: On analysis, I found the: - i. Questioned paint chips recovered from mailbox ("Item 3") to be similar with the known paint sample ("Item 1"). ii. Questioned paint chip recovered from street lamp ("Item 2") to be dissimilar with the known paint sample ("Item 1"). Hence, I am of the opinion that: - i. The questioned paint chips 'Item 3' could have originated from the damaged area of the suspect vehicle represented by the known paint sample 'Item 1'. ii. The questioned paint chips 'Item 2' did not originate from the damaged area of the suspect vehicle represented by the known paint sample 'Item 1'.
CMK89K	The gold metallic paint recovered from the mailbox (Item 3) consisted of four layers of paint which were consistent in color, layer sequence, chemical composition, and elemental composition to the known paint sample from the damaged area of the suspect vehicle (Item 1). The paint from Item 3 could have come from the known paint sample (Item 1) or any other source with similar characteristics. The gold paint recovered from the street lamp (Item 2) was dissimilar to the known paint sample from the damaged area of the suspect vehicle (Item 1) in color, layer structure, chemical composition and elemental composition. The samples were examined by stereomicroscopy, comparison polarized light microscopy, Fourier transform infrared spectroscopy, microspectrophotometry, and scanning electron microscopy with energy dispersive spectroscopy.
CT8YC8	Results: 1. Item 1 consisted of one piece of painted metal having the paint layer sequence: clear / light brown metallic / medium grey / dark grey. 2. Item 2 consisted of two pieces of painted metal having the paint layer sequence: clear / light brown metallic / medium grey /dark grey. The clear and light brown metallic paint layers in Item 2 were indistinguishable in physical characteristics and chemical composition from the corresponding paint layers in Item 1. The medium grey and dark grey paint layers in Item 2 were similar in physical characteristics to, but different in chemical composition from, the corresponding paint layers in Item 1. 3. Item 3 consisted of two pieces of painted metal having the paint layer sequence: clear / light brown metallic / medium grey / dark grey. The paint layers in Item 3 were



TABLE 3

WebCode	Conclusions
	<p>indistinguishable in physical characteristics and chemical composition from the corresponding paint layers in Item 1. Conclusions: 1. The questioned paint sample, Item 2, did not originate from the source of the known paint sample, Item 1 (see Remark 1). 2. The questioned paint sample, Item 3, originated either from the source of the known paint sample, Item 1, or from another source of paint indistinguishable in physical characteristics and chemical composition. Remarks: 1. The term "source" refers to the specific area of the vehicle from which the paint sample was taken.</p>
CUX36E	<p>On examination and analysis I found as follows: - i) The questioned paint chips recovered from street lamps "Item 2" is not similar with known paint sample "Item 1". ii) The questioned paint chips recovered from mailbox "Item 3" is similar with known paint sample "Item 1".</p>
CYQHDM	<p>I compared the questioned paint chips, item 001-2, recovered from a street lamp and the questioned paint chips, item 001-3, recovered from a mailbox to the known paint sample, item 001-1, representative of the damaged area of the suspect vehicle. I used stereo microscopy, fluorescence stereo microscopy, polarized light microscopy, infrared microspectrophotometry, visible microspectrophotometry, raman microspectrophotometry, scanning electron microscopy with energy dispersive spectrometry, and pyrolysis gas chromatography mass spectrometry. All paint chips are layered with a top clear layer over a grey brown color effect layer over a grey primer layer over a dark grey primer layer on a metal substrate. The questioned paint chips, item 001-3, are indistinguishable from the known paint chip, item 001-1, in color, layer structure, microscopical appearance, organic composition, and elemental composition. The question paint chips, item 001-2, have grey primer layer that is different in microscopical appearance and organic composition when compared to the known paint sample, item 001-1. The grey brown questioned paint chips, item 001-3, could have come from the damage area of the vehicle as represented by the known paint chip, item 001-1, or any other paint source with the same color, layer structure, and chemical composition. The grey brown questioned paint chips, item 001-2, did not come from the damaged area of the suspect vehicle as represented by item 001-1.</p>
D3BR3D	<p>Item 2 questioned paint from the street lamp is dissimilar to Item 1 known paint sample representative of the damaged area on suspect vehicle with respect to physical and chemical differences. Therefore, Item 2 questioned paint could not have originated from the paint in the damaged area on the suspect vehicle as represented in Item known paint sample.[sic] Item 3 questioned paint from the mailbox is indistinguishable from Item 1 known paint sample with respect to their layer structures, layer colors, layer textures, chemical characteristics, pigment characteristics, and microspectrophotometry characteristics and either originated from the damaged area on the suspect vehicle as represented in Item 1 or from another source of automotive paint having the same characteristics.</p>
D9YAJB	<p>Microscopic and instrumental examination and comparison of the paints from Item 1 and Item 2 reveals dissimilarities in the chemical composition of one of the primer layers. The paint from Item 2 did not originate from the same source as the paint in Item 1. Microscopic and instrumental examination and comparison of the paints from Item 1 and Item 3 reveals similarities in layer structure and chemical composition. The paint from Item 3 could have originated from the same source as the paint in Item 1.</p>
D9YC9E	<p>The questioned paint in Item 3 corresponded in color and layer structure (clear coat, grey/bronze base coat, light grey primer, dark grey primer), chemical composition (FTIR, PGCMS), and elemental composition (SEM/EDS) to the known paint in Item 1. Therefore, Items 1 and 3 could have a common source (Type 3 Association). It should be noted that since similar items may have been manufactured that would be indistinguishable from the submitted evidence, an individual source cannot be determined. The question paint from Item</p>



TABLE 3

WebCode	Conclusions
	<p>2 had one layer that was slightly different in color and displayed a different chemical composition (FTIR) than the known paint in Item 1. Therefore, the paint from Item 2 did not come from the same source where the known sample (Item 1) was collected (Elimination). KEY for instrument acronyms: FTIR – Fourier Transform Infrared Spectroscopy, PGCMS – Pyrolysis Gas Chromatography Mass Spectrometry, SEM/EDS – Scanning Electron Microscopy/Energy Dispersive Spectroscopy. Interpretation: The following descriptions are meant to provide context to the opinions reached in this report. Every type of conclusion may not be applicable in every case or for every material type. Type 1 Association: Identification- An association in which items share individual characteristics and/or physically fit together that demonstrate the items were once from the same source. Type 2 Association: Highly likely- An association in which items correspond in all measured physical properties, chemical composition and/or microscopic characteristics and share distinctive characteristic(s) that would not be expected to be found in the population of this evidence type. The distinctive characteristics were not sufficient for a Type 1 Association. Type 3 Association: Could have- An association in which items correspond in all measured physical properties, chemical composition and/or microscopic characteristics and could have originated from the same source. Because it is possible for another sample to be indistinguishable from the submitted evidence, an individual source cannot be determined. Type 4 Association: Cannot eliminate- An association in which items correspond in some but possibly not all measured physical properties, chemical composition and/or microscopic characteristics and cannot be eliminated as coming from the same source. This type of evidence may be commonly encountered in the environment, may have limited comparative value and/or there may be factor(s) limiting the comparison. Inconclusive: No conclusion could be reached regarding an association between the items. Elimination: Items exhibit dissimilarities in one or more of the following: physical properties, chemical composition or microscopic characteristics and, therefore, conclusively did not originate from the same source. Non-Association: Items exhibit dissimilarities but certain details or features are not sufficient for an Elimination.</p>
DGPUN9	<p>Items #1, #2, and #3 all consist of four layers of automotive paint on a metal substrate in the following sequence: metal substrate, dark gray primer, gray primer, beige metallic looking basecoat, clearcoat. All four layers of paint in Items #1 and #3 are similar in all examined characteristics and thus Item #3 could have originated from the same source as Item #1 or a similarly painted source. The gray primer layer in Item #2 is dissimilar to the gray primer layer in Item #1. Thus, Item #2 did not originate from the same location as the source of paint for Item #1.</p>
DQDNYK	<p>The suspect vehicle (as represented by Item 1) is excluded as a possible source of the paint chips recovered from the street lamp (Item 2). The suspect vehicle (as represented by Item 1) cannot be excluded as a possible source of the paint chips recovered from the mailbox (Item 3). The paint chips recovered from the mailbox are either from the suspect vehicle or from another damaged vehicle with paint indistinguishable in colour, layer sequence, microscopic appearance and chemical composition. Other sources of indistinguishable paint would include other vehicles of the same colour manufactured at the same plant during the time this paint formulation was in use.</p>
DR7NUA	<p>The questioned paint chips recovered from the mailbox, Item 3, may come from the damaged area of the suspect vehicle represented by Item 1. The questioned paint chips recovered from the street lamp, Item 2, was not originated from the damaged area of the suspect vehicle represented by Item 1.</p>
DVB6DY	<p>Item 2 is different from Items 1 and 3. Item 3 is consistent to Item 1.</p>
E9BCJF	<p>Item 2, the paint sample labeled “questioned paint from the street lamp”, displays differences</p>

TABLE 3

WebCode	Conclusions
	in physical characteristics, chemical composition and elemental composition as compared to item 1, paint sample labeled "known paint sample from the suspect's vehicle". Elimination. Item 3, the paint sample labeled "questioned paint from the mailbox", is consistent in color, physical characteristics, chemical composition, and elemental composition as compared to item 1, paint sample labeled "known paint sample from the suspect's vehicle". Level III association.
EDAJB6	Microscopic analysis conducted on the three items revealed that item 1 and item 3 are similar in their layer structure and layer colours. Each item consists of paint with four layers: a clear coat layer, an effect brown layer and two grey primers, primer surfacer brighther[sic] than first primer. Item 2 consists of paint with four layers: a clear coat layer, en effect brown layer, a brigh[sic] grey primer surfacer and a dark first primer. The organic (FTIR) analysis made upon clear coat an top coat of the three items, showed no differences among the three items, but primer surfacer and first primer spectra of items 1 and 3 were different from item-2 spectra. The inorganic (SEM-EDX) analysis and the pigment analysis (RAMAN) made upon top coat, primer surfacer and first primer of item 1 and 3 showed no differences. According to the microscopic and analytical results, questioned paint chips recovered from the street lamp (item 2) can't come from the suspect vehicle (item 1). Nevertheless, questioned paint chips recovered from mailbox (item 3) were undistinguishable in colour layer, inorganic and organic composition from samples recovered on the suspect vehicle. Therefore, it can't be excluded than samples recovered from the mailbox come from the suspect vehicle or from a vehicle with a similar paint.
ER8VJ9	The paint fragments in Items #1 and #3 were alike with respect to their color, texture, layer structure, chemical solubilities, inorganic composition and organic composition. It was concluded that the Item #3 paint could have had a common origin with Item #1 or another source painted in the same manner. Differences were noted between the paint fragments in Item #1 and #2.
FBDN22	Questioned paint samples from a street lamp (Item 2) and from a mailbox (Item 3) were compared to known paint samples from a vehicle (Item 1), using microscopy, fluorescence, infrared spectroscopy, and scanning electron microscopy - energy dispersive spectroscopy (SEM-EDS). Items 1 and 3 were also compared using microspectrophotometry. Each sample consisted of four layers of paint with a metallic gray appearance. Comparison of Item 1 and Item 2: The upper undercoat layer of the questioned paint from the street lamp differed from the respective layer of the known vehicle paint in microscopical appearance and chemistry. This questioned paint sample did not originate from the area of the suspect vehicle represented by Item 1. Comparison of Item 1 and Item 3: Each layer of the questioned paint from the mailbox was similar to the respective layer of the known vehicle paint in each test performed. The vehicle is a possible source of this questioned paint sample. Because similar items have been manufactured that would be indistinguishable from the submitted evidence, an individual source cannot be determined.
FEXFBH	The questioned paint chips recovered from the mailbox (item 3) could have come from the damaged area of suspect vehicle (represented by item 1) or any other object with a similar paint system.
FJM2XB	On analysis, I found: i) the questioned paint chips recovered from mailbox (Item 3) to be similar to the paint sample representative of the damaged area of suspect vehicle (Item 1) in texture, layering, solubility properties and IR spectrum. I am of the opinion that the questioned paint chips in Item 3 could have come from the damaged are[sic] of suspect vehicle. ii) the questioned paint chips recovered from street lamp (Item 2) to be dissimilar to the known paint sample representative of the damaged area of suspect vechile[sic] (Item 1) in texture, layering,

TABLE 3

WebCode	Conclusions
	solubility properties and IR spectrum. I am of the opinion that the questioned paint chip in Item 2 could not have come from the damaged area of suspect vehicle.
FR3TAU	All four layers in item 3 were physically and chemically indistinguishable from the same four layers in item 1. It was possible to distinguish at least one of the layers in item 2 (layer 3) from the same layer in item 1. Items 1 and 2 are different.
FUAZQ2	All three items appeared to be coated with the same number of layers of paint, and the corresponding layers appeared to be the same color. An infrared spectrum of the coatings on Item 1 was consistent with a spectrum of the coatings on Item 3; however, the spectrum of the coatings on Item 2 contained additional bands consistent with the presence of an epoxy. Therefore, Item 1 could not have originated from Item 2.[sic]
FVH4KD	Paint Examination and Comparison: Comparative examinations of the Known paint (Item #1) to the questioned paint (Item #3) gave consistent microscopic, chemical and instrumental (Fourier Transform InfraRed, Pyrolysis Gas Chromatography) results. Therefore, in the opinion of this examiner, the Questioned paint sample from the mailbox (Item #3) could have originated from the suspect vehicle as represented by the Known submitted exemplar[sic] (Item #1) or from another source exhibiting all of the same analyzed characteristics. Comparative examination of the Known paint (Item #1) to the questioned paint (Item #2) gave consistent microscopic and chemical results, however, different instrumental (Fourier Transform InfraRed, Pyrolysis Gas Chromatography) results were obtained. Therefore in the opinion of this examiner, the Questioned paint sample from the street lamp (Item #2) could not have come from the suspect vehicle as represented by the Known submitted exemplar[sic] (Item #1).
G32UKD	Item 1: Four layer metallic brown paint standard. Item 2: Two, four layer metallic brown paint chips were found. In the sample analyzed, the unknown paint and the standard paint (Item #1) from the suspect vehicle are not the same in physical and chemical characteristics. The unknown paint from the street lamp could not have originated from the standard. Item 3: Two, four layer metallic brown paint chips were found. In the sample analyzed, the unknown paint and the standard paint (Item #1) from the suspect vehicle are the same in physical and chemical characteristics. The unknown paint from the mailbox either originated from the standard from the suspect vehicle or another source of paint possessing the same distinct physical and chemical characteristics.
GCJFL2	Based upon the tests conducted, item 3, from the mailbox could have originated from the suspect vehicle, item 1. The paint in each of these items appears to be typical of a factory finish rather than a respray. In my opinion, I have evaluated the findings as providing strong support for the suspect vehicle (item 1) being in collision with the mailbox (item 3). The paint in item 2 is different from the suspect vehicle and thus indicates that the vehicle has not been in collision with the street lamp.
GEV8JB	The Item 1 known paint was compared to the Item 2 and Item 3 questioned paints, the Item 1 known paint was a four layer paint consisting of a clear coat, beige metallic color coat, light gray primer, and dark gray primer. The Item 2 questioned paint is a four layer paint consisting of a clear coat, beige metallic color coat, light gray primer, and dark gray primer, This paint was different from the Item 1 known paint in chemical composition. Therefore, the Item 2 questioned paint could not have originated from the same source as represented by Item 1. This is an elimination. The Item 3 questioned paint was a four layer paint consisting of a clear coat, silver metallic color coat, light gray primer, and dark gray primer; the four layers present in the Item 1 known paint are similar in color, layer structure, and chemical composition to the respective layers in the 1.3[sic] questioned paint. Therefore, the Item 3 questioned paint could have originated from the source as the Item 1 known paint or another source with the same

TABLE 3

WebCode	Conclusions
GHUJHV	<p>color, layer, and chemical composition.</p> <p>Physical and chemical examinations indicate that Items 1 and 3 are indistinguishable from one another. Therefore, Item 3 originated from the vehicle represented by Item 1 or from another vehicle that was painted in the same manner (Level III). This conclusion was reached because other vehicles produced at the same manufacturing plant, with the same specifications would have paint applied in the same manner, and would therefore also be indistinguishable. Items 1 and 2 differ physically and chemically (Elimination). Therefore, they do not share a common source. An association scale, which is necessary to fully interpret the context of the reported findings, is attached to this report. [Participant included an association scale that could not be replicated within the report.]</p>
GTDVT9	<p>Items 1 and 3 are consistent in color, appearance, layer sequence and chemical composition. Items 1 and 2 are different in color and chemical composition of the upper primer layer. The questioned paint chips recovered from the mailbox (Item 3) could have originated from the damaged area of the suspect vehicle (Item 1) or from another damaged vehicle with paint exhibiting all of the same analyzed/measured characteristics. The paint chips recovered from the street lamp (Item 2) could not have come from the damaged area of the suspect vehicle (Item 1), as represented by the submitted sample.</p>
H87WYE	<p>Questioned paint samples from street lamp (lab item #2) and from mailbox (lab item #3) were submitted to the Police Laboratory for paint analysis and comparison to the known paint sample from the suspect's vehicle (lab item #1). Visual and microscopic examination of lab items #1, 2, and 3 disclosed the following layer structures: K (lab item #1, one chip): top clearcoat (layer 1)/brown colorcoat with dense decorative flakes (layer 2)/light grey primer (layer 3)/grey primer (layer 4)/pretreatment (possible metal); Q1 (lab item #2, two chips): top clearcoat (layer 1)/brown colorcoat with dense decorative flakes (layer 2)/light grey primer (layer 3)/grey primer (layer 4)/pretreatment (possible metal); Q2 (lab item #3, two chips): top clearcoat (layer 1)/brown colorcoat with dense decorative flakes (layer 2)/light grey primer (layer 3)/grey primer (layer 4)/pretreatment (possible metal). Visual and microscopic examination of questioned paints Q1 and Q2 and comparison to known paint K disclosed that they are consistent and no discriminating differences were observed with respect to their color, texture, and layer structures. K (layers 1-4), both chips of Q1 (layer 3), and one of the Q2 chips, designated to be Q2A, (layers 1-4) were analyzed by Fourier Transform Infrared Spectroscopy (FTIR). FTIR instrumental analysis disclosed that layer 3 of Q1 has different chemical composition than layer 3 of K. It is the opinion of the undersigned that that[sic] the questioned paint Q1 could not have come from the same source as represented by the known paint K. Known paint K (layers 1-4) and questioned chip Q2A (layers 1-4) were analyzed by X-Ray Fluorescence Spectrometry (XRF). Instrumental analysis (FTIR and XRF) of questioned chip Q2A and comparison to known paint K disclosed that they are consistent and no discriminating differences were observed with respect to chemical type and elemental composition. It is the opinion of the undersigned that the questioned chip Q2A, could have come from the same source as represented by the known submitted exemplar, K, or from another source exhibiting all of the same analyzed characteristics. No further conclusions can be reached about Q2 chip not instrumentally analyzed.</p>
HNC9EB	<p>Examination of Items #1, #2, and #3 revealed the presence of metal pieces painted silver/gold reflective with the following layer structure: clear, silver/gold, light gray, and dark gray. The questioned silver/gold reflective paint from the street lamp, Item #2, was not chemically consistent with the known paint from the damaged area of the suspect vehicle, Item #1. Therefore, Item #2 could not have originated from the same source as the paint from Item #1. The questioned silver/gold reflective paint from the mailbox, Item #3, was physically</p>

TABLE 3

WebCode	Conclusions
	and chemically consistent with the known paint from the damaged area of the suspect vehicle, Item #1. Therefore, Item #3 could have originated from the same source as the paint from Item #1.
HXH3P3	The chemical compositions of the paint of Item 1 and Item 2 were different and therefore Item 2 could not have originated from the same source as Item 1.
KFTW72	Items 1 and 3 each showed a clearcoat layer, brownish topcoat layer, light gray primer and dark gray primer layer. The corresponding layers in these two samples were consistent in color, microscopical appearance, polymer composition and elemental composition. The paint in Item 3 could have originated from the source represented by Item 1. The light gray primer layer in Item 2 had a different polymer composition than the light gray primer in Item 1. Item 2 could not have originated from the source represented by Item 1.
KLZDN3	The questioned paint in item 3 is consistent with the known paint in item 1 on the basis of color, texture, layer structure and chemical composition. The questioned paint in item 2 is not consistent with the known paint in item 1 on the basis of chemical composition.
KUEZYR	The following samples of paint were compared: Item 1 Known paint sample representative of the damaged area of the suspect vehicle. Item 2 Questioned paint chips recovered from the street lamp. Item 3 Questioned paint chips recovered from mailbox. The paint sample of item 1 and the paint sample of item 3 are similar in color, layer structure and chemical composition. Accordingly the item 1 and item 3 paints originated from the same vehicle or from different vehicles painted in the same manner. The paint sample from item 2 differs from the paint sample of item 1 in chemical composition. The paint sample from Item 2 did not come from the same source as the paint sample from Item 1. Paint comparisons were performed using Fourier transform infrared spectroscopy, polarized light microscopy, microspectrophotometry, pyrolysis gas chromatography with mass spectrometry, and scanning electron microscopy with energy dispersive x-ray spectroscopy.
L4W2UR	Exhibit 2 could not have originated from the same source as Ex. 1. Exhibit 3 could have originated from the same source as Ex. 1.
M3F7PC	Four layers of a paint-like substance (clear/grey "metallic"/light grey/dark grey), on a metal-like substrate, were located in submission #1-1 (known paint sample from damaged area of suspect vehicle) and was retained at the laboratory as #1-1Z1. Instrumental analysis (FTIR and SEM) was performed on #1-1Z1 layers 1 through 4. Two paint chips with four layers of a paint-like substance (clear/grey "metallic"/light grey/dark grey), on a metal-like substrate, were located in submission #1-2 (questioned paint chips recovered from street lamp) and was retained at laboratory as #1-2Z1. Instrumental analysis (FTIR) was performed on #1-2Z1 layers 1 through 4. This paint sample (#1-2Z1) exhibited dissimilar instrumental characteristics (FTIR) to the light grey coat (layer 3) in item #1-1Z1 (known paint sample representative of the damaged dining room wall).[sic] Two (2) paint chips with four layers of a paint-like substance (clear/grey "metallic"/light grey/dark grey), on a metal-like substrate, were located in submission #1-3 (questioned paint chips recovered from the mailbox) and was retained at the laboratory as #1-3Z1. One chip was analyzed instrumentally (FTIR and SEM) and designated #1-3Z1A. This paint exhibited similar microscopic and instrumental characteristics (FTIR and SEM) to the four layers of paint (clear/grey "metallic"/light grey/dark grey) located in item #1-1Z1 (known paint sample representative of the damaged area of suspect vehicle). The remaining paint-like chip was designated #1-3Z1B and was not analyzed instrumentally.
MLUHH3	Known paint (Item 1), reportedly from the suspect vehicle was found to be inconsistent with the questioned paint (Item 2), reportedly from the street lamp, with respect to microchemical

TABLE 3

WebCode	Conclusions
	<p>properties and composition. Known paint (Item 1), reportedly from the suspect vehicle was found to be consistent with the questioned paint (Item 3), reportedly from the mailbox, with respect to color, texture, layer sequence, chemical and physical properties and composition. Based upon these observations, it is the opinion of this analyst that the known paint (Item 1) and the questioned paint (Item 3) are of the same type and could have a common origin. This analyst recognizes that other sources of paint with properties consistent with the above paint exist.</p>
MM36K9	<p>Item 2, the paint sample labeled "questioned paint chips recovered from street lamp" displays differences in physical characteristics and chemical composition as compared to item 1, the paint sample labeled "known paint sample representative of the damaged area of suspect vehicle". Elimination. Item 3, the paint sample labeled "questioned paint chips recovered from mailbox" is consistent in physical characteristics, chemical composition, and elemental composition as compared to item 1, the paint sample labeled "known paint sample representative of the damaged area of suspect vehicle". Level III association.</p>
MTT8Y7	<p>Item 2 consisted of two small medium gray metallic paint chips. Microscopical examination revealed the following layer structure: clear coat/metallic gray base coat/light gray primer/medium gray primer. Analysis of Item 2 revealed differences in physical characteristics and chemical properties upon comparison to Item 1. Accordingly, the source of Item 1 is excluded as the source of the paint in Item 2. Item 3 consisted of two small medium gray metallic paint chips. Microscopical examination revealed the following layer structure: clear coat/metallic gray base coat/light gray primer/dark gray primer. Item 3 demonstrated similarities in physical characteristics and chemical properties upon comparison to Item 1. Accordingly, Item 3 could have originated from the same source as Item 1 or another source with the same physical characteristics and chemical properties.</p>
MWW9Y4	<p>The four-layer paint sampled from items 1 (Known - Vehicle) and 2 (Questioned - Street Lamp) were found to be similar in appearance (Stereomicroscope) and color (Comparison Microscope), but dissimilar in organic composition (FTIR). The damaged portion of the suspect vehicle is not the source of the paint removed from the street lamp. The four-layer paint sampled from items 1 (Known - Vehicle) and 3 (Questioned - Mailbox) were found to be similar in appearance (Stereomicroscope), color (Comparison Microscope), and organic composition (FTIR). The damaged portion of the suspect vehicle (or another vehicle with similar paint composition) cannot be excluded as a possible source of the paint removed from the mailbox.</p>
MYZTNN	<p>Paints chips of Item 1 and Item 3 have their layers with equal shape, width and number of them. Chemicals and elemental composition analyse (SEM/EDX) are coincident. Item 2 has different spectrums and chemicals elements are different too when SEM/EDX analyse has been done. [sic]</p>
N3WN2W	<p>Microscopic and instrumental examinations of item 1 and item 2 revealed that the exhibits are not comparable in terms of the layer colours and texture and binder characteristics of their respective primer layers. Microscopic and instrumental examinations of item 1 and item 3 revealed that the exhibits are comparable in terms of the layer colours, structures, texture and binder characteristics of their respective layers. It is therefore concluded that item 3 could have originated from the same source as item 3[sic] or from another source of automotive paint having the same characteristic.</p>
N6GQR3	<p>Examinations of Items 1 (known paint sample representative of the damaged area of the suspect vehicle), 2 (questioned paint chips recovered from street lamp), and 3 (questioned paint chips recovered from mailbox) disclosed the following: a. The paint sample in Item 1</p>



TABLE 3

WebCode	Conclusions
	<p>and the paint chips in Item 3 have the following color/layer structure: clear-colorless/ brown-metallic/light gray/dark gray. Comparative examinations of the paint chips in Item 3 with the paint sample in Item 1 disclosed them to be consistent in their physical characteristics (such as layer structure and color), elemental composition, and organic composition. Therefore, the questioned paint chips in Item 3 could have originated from the damaged area of the suspect vehicle as represented by the paint sample in Item 1. b. The paint chips in Item 2 have the following color/layer structure: clear-colorless/ brown-metallic/gray/dark gray. Comparative examinations of the paint chips in Item 2 with the paint sample in Item 1 disclosed them to be visually dissimilar in their color/layer structure. Further examinations disclosed that the gray paint layer in Item 2 was dissimilar in chemical compositions as compared to the light gray paint layer in Item 1. As a result of these findings, the questioned paint chips in Item 2 did not originate from the damaged area of the suspect vehicle as represented by Item 1.</p>
NMHC UW	<p>Item # 02 - Microscopic and instrumental analysis (Micro-FTIR) of the paint from Items #01(K) and #02(Q) revealed that they are dissimilar with respect to type. Therefore Item #02 (Q) could not have come from the source represented by Item #01 (K). Item #03 - Microscopic and instrumental analysis (Micro-FTIR) of the paint from Items #01(K) and #02[sic] (Q) revealed that they are consistent with respect to color, texture, type and layer structure. Therefore, the paint from Item #03 (Q) could have originated from the known source represented by Item #01(K), another painted vehicular surface exhibiting the same characteristics (color, texture, type and layer structure.) Note: Pyrolysis GC not online for analysis.</p>
PYVQX	<p>Item 2 (multi-layered paint chips from the street lamp) was found to be chemically different from the source represented by Item 1 (the damaged area of the suspect's vehicle) and did not originate from that source. Item 3 (multi-layered paint chips from the mailbox) is the same distinct type of paint as that of the source represented by Item 1 (the damaged area of the suspect's vehicle) and originated from that source or from another source of automotive paint having the same characteristics.</p>
RBDM4X	<p>Items 1A (Item 1 - CTS) and 1B (Item 2 - CTS) were examined and compared using Microscopy and FTIR (Fourier Transform Infrared) Spectroscopy with the following results: Item 1A (tan metallic 4-layer paint recovered from the suspect vehicle) and item 1B (tan metallic 4-layer paint recovered from the streetlamp) could not have originated from the same source due to differences in physical and chemical composition. Items 1A (Item 1 - CTS) and 1C (Item 3 - CTS) were examined and compared using Microscopy, FTIR (Fourier Transform Infrared) Spectroscopy, SEM/EDS (Scanning Electron Microscopy with Energy Dispersive Spectroscopy) and MSP (Microspectrophotometry) with the following results: Item 1A (tan metallic 4-layer paint recovered from the suspect vehicle) and item 1C (tan metallic 4-layer paint recovered from the mailbox) were consistent in color, layer sequence, physical and chemical properties. The paint recovered from the mailbox (1C) could have originated from the suspect's vehicle (1A) or a vehicle painted in the same manner with the same color, layer sequence and physical and chemical properties.</p>
RUNKL9	<p>The questioned paint recovered from the street lamp (item 1B, CTS item 2) did not originate from the area of the vehicle represented by item 1A (CTS item 1). The questioned paint recovered from the mailbox (item 1C, CTS item 3) is the same distinct type of paint as the known paint on the suspect vehicle (item 1A, CTS item 1) and originated either from that source or another source of automotive paint having the same distinct characteristics. RESULTS: The questioned paint from the street lamp (item 1B, CTS item 2) and the questioned paint from the mailbox (item 1C, CTS item 3) were examined for the purpose of determining</p>

TABLE 3

WebCode	Conclusions
	<p>whether or not there is any paint present like that on the suspect vehicle (item 1A, CTS item 1). The paint standard from the suspect vehicle has the following layer structure: 1. Colorless acrylic-melamine enamel clearcoat 2. Dark orange-brown acrylic-melamine enamel basecoat with effect pigment 3. Light gray polyester-melamine enamel primer 4. Dark gray polyester-melamine enamel primer This paint exhibits characteristics typical of an original automotive finish and was used for comparison with questioned paint recovered from the street lamp (item 1B, CTS item 2) and the mailbox (item 1C, CTS item 3). The questioned paint from the street lamp (item 1B, CTS item 2) has the following layer structure: 1. Colorless acrylic-melamine enamel clearcoat 2. Dark orange-brown acrylic-melamine enamel basecoat with effect pigment 3. Light gray epoxy-polyester enamel primer 4. Dark gray polyester-melamine enamel primer. Examination and comparison of the questioned paint from the street lamp (item 1B, CTS item 2) with item 1A (CTS item 1) revealed they are dissimilar with respect to layer texture and general binder types of layers 3 and 4. It is therefore concluded that the questioned paint recovered from the street lamp (item 1B, CTS item 2) did not originate from the area of the suspect vehicle represented by item 1A (CTS item 1). The questioned paint recovered from the mailbox (item 1C, CTS item 3) has the same layer structure as the known paint from the suspect vehicle (item 1A, CTS item 1). Examination and comparison of this questioned paint (item 1C, CTS item 3) with item 1A (CTS item 1) revealed they are alike with respect to layer structure, layer colors, layer textures, microchemical reactivities, binder characteristics, and pigment characteristics. It is therefore concluded that the questioned paint recovered from the mailbox (item 1C, CTS item 3) is the same distinct type of paint as that on the suspect vehicle (item 1A, CTS item 1) and originated either from that vehicle, or from another source of automotive paint having the same distinct characteristics.</p>
RZGLP9	<p>CONCLUSIONS: The questioned paint recovered from the street lamp (item 1B) did not originate from the subject's vehicle as represented by item 1A. The questioned paint recovered from the mailbox (item 1C) is the same distinct type of paint as the known paint on the subject's vehicle (item 1A) and originated either from that vehicle or from another source of automotive paint having the same distinct characteristics.</p>
TL7DE4	<p>The paint sample labeled "questioned paint chips recovered from street lamp", (item 2), displays differences in chemical composition as compared to the paint sample labeled "known paint sample representative of the damaged area of the suspect vehicle", (item 1). Elimination. The paint sample labeled "questioned paint chips recovered from mailbox", (item 3), is consistent in color, physical characteristics, chemical composition, and elemental composition as compared to the paint sample labeled "known paint sample representative of the damaged area of the suspect vehicle", (item 1). Level III association.</p>
TQKALQ	<p>Conclusion) 1. The paint in Exhibit 3 originated either from the source of the paint in Exhibit 1, or from another source painted in an indistinguishable manner. 2. The paint in Exhibit 2 did not originate from the source of the paint in Exhibit 1 (see Remark 1 [Table 4 - Additional Comments] ).</p>
UE77H2	<p>Observations, Analysis and Conclusions: The paint samples were observed visually and with the aid of a stereoscope. In all three Exhibits, layered paint typical of vehicle paint was observed with the structure: clear / clear with suspected metallic effect pigments / light grey / dark grey. Individual layers from each exhibit were analyzed using Fourier-Transform Infrared Spectroscopy (FTIR) to measure chemical characteristics and X-ray Fluorescence Spectroscopy (XRF) to assess elemental composition. XRF was not performed on the uppermost clear layer. Exhibits 1 and 3 were consistent in their elemental and chemical compositions of all corresponding layers. Therefore, Exhibits 1 and 3 cannot be differentiated by these methods.</p>



TABLE 3

WebCode	Conclusions
	The vehicle represented by the Exhibit 1 could be the source of the paint transferred to the mailbox (Exhibit 3). Another damaged vehicle with the same paint layer structure could be an alternate source. Exhibits 1 and 2 differed in at least one corresponding layer. Therefore, the vehicle, as represented by Exhibit 1, cannot be the source of the paint transferred to the streetlamp (Exhibit 2). If the suspect vehicle displays multiple areas of paint damage, a standard should be submitted from each. If further standards are submitted, they could be compared to Exhibit 2.
UX2Y4Y	Examination of Item #1 revealed a paint chip with the following layer structure: clear/gold reflective/medium blue-grey primer/medium grey primer/metal substrate. The paint chip from Item #1 was found to be physically and chemically consistent with the paint chips from Item #3. Therefore, the paint chip from Item #1 and the paint chips from Item #3 could have originated from the same source. The paint chips from Item #2 are not consistent with the paint chip from Item #1. Therefore, the paint chips from Item #2 and the paint chip from Item #1 could not have originated from the same source.
UYB9WW	The questioned paint in item 3 could have originated from the same source as the paint standard in item 1. The questioned paint in item 2 did not originate from the same source as the paint standard in item 1.
VNULMV	The gold metallic paint found in Item 3 is identical to the gold metallic paint found in Item 1 in color, type, texture, layer structure, and elemental composition. This means the paint chips recovered from the mailbox could have come from the suspect vehicle. The gold metallic paint found in Item 2 was different from the gold metallic paint in Item 1. This means the paint chips recovered from the street lamp did not come from the damaged area of the suspect vehicle.
W28F8K	The questioned paint chips recovered from the street lamp (Item 2) and mailbox (Item 3) resemble with the known paint sample (Item 1) representative of the damaged area of suspect vehicle with respect to color and layer sequence (clear coat, metallic color coat, base coat and primer). The chemical compositions from layers of Item 3 are consistent those from the corresponding layers of Item 1 through the analysis by FITR and SEM/EDS. However, the chemical compositions from the layer 3 and 4 of Item 2 are different from that of Item 1. Therefore, Item 3, the questioned paint chip could have originated from the damaged area of the suspect vehicle, but the questioned paint chip, Item 2 could not have originated from the damaged area of the suspect vehicle. [sic]
W332XP	1. Microscope Analysis: Item 1, item 2 and item 3 are the same color and 4 layers painted samples. 2. Chemical Analysis: The layers of item 1 and 3 have the same FT-IR spectrum but that of item 2 is different from the others. 3. Result: The paint chips recovered from mailbox (item 3) have originated from the damaged area of the suspect vehicle (item 1). [sic]
W7338Z	On the basis of physical and chemical analysis, my opinion is that: 1. Questioned paint chips recovered from the mailbox (item 3) could have originated from the suspect vehicle (as represented by item 1). Another source of paint with the same physical and chemical characteristics cannot be excluded; and 2. Questioned paint chips recovered from the street lamp (item 2) could not have originated from the suspect vehicle (as represented by item 1).
W8V43P	[No Conclusions Reported.]
WBX2BW	The paint recovered in Item 3 is similar in color, layer sequence, and chemical composition to the paint recovered in Item 1; therefore, Item 3 could have originated from the same location as Item 1. The paint recovered in Item 2 is similar in color and layer sequence, but dissimilar in chemical composition to the paint recovered from Item 1; therefore, Item 2 did not originate from the same location as Item 1.

TABLE 3

WebCode	Conclusions
WE2PZK	The questioned paint from the mailbox (Item 3) could have originated from the vehicle (Item 1), as represented by the submitted vehicle exemplar, or from another paint source exhibiting all of the same analyzed characteristics. The questioned paint from the street lamp (Item 2) could not have originated from the vehicle (Item 1), as represented by the submitted vehicle exemplar.
WEY8RN	Item 3 could have originated from the suspect vehicle (item 1).
WKLQFX	Item 1: One dark grey metallic paint standard, composed of four layers, was analyzed. Item 2: Two dark grey metallic paint chips were found. In the sample analyzed, the dark grey metallic paint chip was found to have four layers. The unknown dark grey metallic paint chip from the "street lamp" and the standard dark grey metallic paint from "the damaged area of suspect vehicle" are not the same in physical (texture) or chemical characteristics. The unknown paint from the "street lamp" could not have originated from the standard dark grey metallic paint from "the damaged area of suspect vehicle." Item 3: Two dark grey metallic paint chips were found. In the sample analyzed, the dark grey metallic paint chip was found to have four layers. The unknown dark grey metallic paint chip from the "mailbox" and the standard dark grey metallic paint from "the damaged area of suspect vehicle" are the same in physical (color and layer sequence) and chemical characteristics. The unknown dark grey metallic paint from the "mailbox" either originated from the standard dark grey metallic paint from "the damaged area of the suspect vehicle" or another source of paint possessing the same distinct physical and chemical characteristics.
WWGYYZ	The paint samples from Items 1 and 3 are similar in layer structure, chemical composition, and microscopic characteristics, and could share a common source. The paint sample from Item 2 has differences in layer structure and chemical composition of the layers, and therefore could not have originated from the same source as the paint in Item 1.
X99XHP	Three items are the same in number of layers, layer configuration, color by visual examination. Each item consists of clear top coat, metallic base coat, gray primer spacer and dark gray primer. Chemical analysis using FTIR showed that binder of primer spacer of item 2 is different from that of item 1. But item 3 doesn't show any differences visually and chemically. So Item 3 could have originated from the damaged suspected vehicle.
XKF37W	Questioned paint Q1a and Q1b (lab item 2) and known paint K1 (lab item 1) were stereoscopically examined. Q1a (layers 1 through 4), Q1b (layer 3) and K1 (layers 1 through 4) were instrumentally analyzed using Fourier Transform Infrared Spectroscopy (FTIR). These analyses disclosed that questioned paint Q1a and Q1b and known paint K1 are consistent and no discriminating differences were observed with respect to their color, texture, and layer structure. However, they were found to be different with respect to chemical type. It is the opinion of the undersigned that the questioned paint Q1a and Q1b (lab item 2) could not have come from the source represented by the known paint K1 (lab item 1). Questioned paint Q2a and Q2b (lab item 3) and known paint K1 (lab item 1) were stereoscopically examined. Questioned paint Q2a and known paint K1 were instrumentally analyzed using Fourier Transform Infrared Spectroscopy (FTIR) and X-Ray Fluorescence (XRF). These analyses disclosed that questioned paint Q2a and Q2b and known paint K1 are consistent and no discriminating differences were observed with respect to their color, texture and layer structure. Additionally, questioned paint Q2a and known paint K1 are consistent and no discriminating differences were observed with respect to chemical type and elemental composition. It is the opinion of the undersigned that the questioned paint, Q2a (lab item 3), could have come from the same source as represented by the known submitted exemplar, K1 (lab item 1), or from another source exhibiting all of the same analyzed characteristics. Questioned paint Q2b

TABLE 3

WebCode	Conclusions
	was not instrumentally analyzed and no further conclusions can be made regarding this particle.
Y2H2UQ	On the analysis, I found that: a) The questioned paint chip (Item 3) to be similar to the known paint chip (Item 1). b) The questioned paint chip (Item 2) to be dissimilar to the known paint chip (Item 1). Thus, I am of the opinion that the questioned paint chip (Item 3) could have originated from the damaged area of the suspect's vehicle.
Y4DD2D	Based on the analytical methods used, the questioned paint recovered from the mailbox (represented by Item 3) can not be discriminated from the paint at the damaged area of the suspect vehicle (represented by Item 1). The questioned paint recovered from the street lamp (represented by Item 2) is different from the paint at the damaged area of the suspect vehicle (represented by Item 1).
YC44CL	The questioned paint chip that was recovered from te[sic] mailbox (item 3) had the same organic chemical composition and layer sequence and could have originated from the damaged area of the suspect vehicle (Item 1) or another vehicle with same paint system. The paint from the damaged area of the suspect vehicle (Item 1) was eliminated as the source of questioned paint chip that was recovered from the street lamp (Item 2) as they were found to have different organic chemical compositions.
YGVDLK	The questioned paint chips Items 2 and 3 could not have originated from the damaged area of the suspect vehicle represented by Item 1.
YHPYDQ	1. Microscopic Analysis: Each paint chips of Item1, Item2 and Item3 are consist of 4 layers. 2. Chemical Anlysis by FT-IR: The second and third layers of item1 are different from item2 and similar to item3. 3. Result: The paint chip recovered from suspect vehicle(item1) is differnt from paint chip of street lamp (item2) and similar to paint chip of mail box (item3). [sic]
YM6MXM	The known paint from the damaged area of the suspect's vehicle consisted of a four-layer brown paint with a metallic appearance and was used as a comparison standard. The sampled questioned paint chip recovered from the mailbox (Item 3) consisted of a four-layer brown paint with a metallic appearance which is similar in visual color, layer sequence, paint type, and paint composition to the known paint from the damaged area of the suspect's vehicle (Item 1). It is our opinion that the questioned paint recovered from the mailbox could have come from the suspect's vehicle or any other source which exhibits similar paint characteristics. The sampled questioned paint chip recovered from the lamp post (Item 2) consisted of a four-layer brown paint with a metallic appearance which is similar in visual color but dissimilar in paint type to the known four-layer paint from the damaged area of the suspect's vehicle. It is our opinion that the questioned paint recovered from the lamp post could not have come from the damaged area of the suspect's vehicle. Please note, different areas of a vehicle can exhibit different paint characteristics. If additional analysis is necessary, please resubmit the evidence along with an additional known paint standard from the suspect's vehicle, or any other suspected vehicle, preferably from areas exhibiting damage.
Z7AQPN	Examinations of items #1, #2 and #3 revealed the presence of paint chips with the similar layer structure. The paint in items #2 and #3 were found to be physically consistent with item #1. Comparative examination using FTIR found that, item #2 and #3 were similar to item #1. As a result of these findings, the questioned paint chips submitted in item #2 and #3, could be originated[sic] from the same source as the paint in item #1.
ZCY97K	On analysis, I found Item 3 to be similar to Item 1 while Item 2 not similar to Item 1.
ZGEJJP	1). The paint chips recovered from the street lamp (Items[sic] 2) was found to be not similar with the known paint sample representative of the damaged area of the suspect vehicle (Item

TABLE 3

WebCode	Conclusions
	<p>1). Hence, Item 2 could not have originated from Item 1. 1). The paint chips recovered from the mailbox (Item 3) was found to be similar with the known paint sample representative of the damaged area of the suspect vehicle (Item 1). Hence, Item 3 could have originated from Item 1.</p>
ZKU2MR	<p>Results of Laboratory Examination: The Item 1 known automotive paint was compared to the questioned paints in Items 2 and 3. The Item 1 known paint was similar to the Items 2 and 3 questioned paints in color and layer structure (clear-light brown flake- light grey primer- dark grey primer), however, Item 2 was different from the Items 1 and 3 paints in chemical composition (FTIR). Therefore, the Item 2 paint can be eliminated as coming from the same source as the Item 1 and 3 paints (Elimination). However, it should be noted that different areas of a car can have different paint systems. The Item 1 known paint and the Item 3 questioned paint were also found to be similar in chemical composition (FTIR), microscopic appearance (compound microscope), elemental composition (SEM-EDS), and chemical solubilities. Therefore, these two paints could have come from a common source (Type 3 Association). It should be noted that since other items may have been manufactured with a similar paint system that would be indistinguishable from the submitted evidence, an individual source cannot be determined. KEY for instrument acronyms: FTIR – Fourier Transform Infrared Spectroscopy, PLM – Polarized Light Microscopy, SEM/EDS – Scanning Electron Microscopy/Energy Dispersive Spectroscopy. Interpretation: The following descriptions are meant to provide context to the opinions reached in this report. Every type of conclusion may not be applicable in every case or for every material type. Type 1 Association: Identification- An association in which items share individual characteristics and/or physically fit together that demonstrate the items were once from the same source. Type 2 Association: Highly likely- An association in which items correspond in all measured physical properties, chemical composition and/or microscopic characteristics and share distinctive characteristic(s) that would not be expected to be found in the population of this evidence type. The distinctive characteristics were not sufficient for a Type 1 Association. Type 3 Association: Could have- An association in which items correspond in all measured physical properties, chemical composition and/or microscopic characteristics and could have originated from the same source. Because it is possible for another sample to be indistinguishable from the submitted evidence, an individual source cannot be determined. Type 4 Association: Cannot eliminate- An association in which items correspond in some but possibly not all measured physical properties, chemical composition and/or microscopic characteristics and cannot be eliminated as coming from the same source. This type of evidence may be commonly encountered in the environment, may have limited comparative value and/or there may be factor(s) limiting the comparison. Inconclusive: No conclusion could be reached regarding an association between the items. Elimination: Items exhibit dissimilarities in one or more of the following: physical properties, chemical composition or microscopic characteristics and, therefore, conclusively did not originate from the same source. Non-Association: Items exhibit dissimilarities but certain details or features are not sufficient for an Elimination.</p>
ZMHBXE	<p>The paint in Item #2 is similar in color and layer sequence but dissimilar in chemical analysis to the paint in Item #1. The paint in Item #2 did not originate from the immediate vicinity of the same source as the paint in Item #1. The paint in Item #3 is similar in color, layer sequence, and chemical analysis to the paint in Item #1. The paint in Item #3 could have originated from the immediate vicinity of the same source as the paint in Item #1.</p>
ZNAG9D	<p>The paint sample from the suspect vehicle (Item 1) corresponded to the paint in question from the mailbox (Item 3) with respect to color and layer structure (SM), chemical composition (FTIR), and elemental composition (XRF). Therefore, the paint chips recovered from the mailbox could have originated from the suspect vehicle. It should be noted that an individual</p>

TABLE 3

WebCode	Conclusions
	<p>source cannot be determined since other painted items may have been manufactured that would be indistinguishable from the submitted evidence. The paint sample from the suspect vehicle (Item 1) was different in the primer layer with respect to chemical composition (FTIR) and elemental composition (XRF) compared to the questioned paint from the street lamp (Item 2). Therefore, the suspect vehicle (Item 1) can be eliminated as a source of the paint chips recovered from the street lamp. Examinations Conducted: Stereo microscopy (SM), Fourier Transform Infrared Spectrometer (FTIR), X-ray Fluorescence Spectrometer (XRF).</p>
ZUGZDX	<p>Known paint sample in item 1 from the damaged area of suspect vehicle comprised one piece of 4-layered metallic grey fragment having a first colourless layer, a second metallic grey layer, a third grey layer and a fourth dark grey layer. Questioned paint sample in item 2 from the street lamp comprised two pieces of 4 layered metallic grey paint fragments, agreeing in colour and layer sequence with the known paint sample in item 1. However, the third layer of this questioned paint sample item 2 was found to differ in chemical composition with the corresponding layer of the known paint sample item 1. This finding indicated that the questioned paint sample item 2 did not originate from the damaged area of the suspect vehicle from which the known paint sample item 1 was taken. Questioned paint sample in item 3 from the mailbox comprised two pieces of 4-layered metallic grey paint fragments, agreeing in colour, layer sequence and chemical composition with the known paint sample in item 1. This finding indicated that the questioned paint sample item 3 had likely originated from the damaged area of the suspect vehicle from which the known paint sample item 1 was taken.</p>

# Additional Comments

TABLE 4

WebCode	Additional Comments
2AQDYM	I would request further samples in relation to the suspect vehicle, if these were available, to ascertain if variation between panels or spot repair may account for the differences seen.
6LEAZC	An "Association Scale for Trace Evidence" would be included at the end of the report to provide context to the "levels" of opinions reached.
6XZTA8	Item 3 is very similar to Item 1 but the second layer from the metal substrate in Sample 1 is thicker than it is in Sample 3.
8WLYQC	"Item 1" to "Item 3" were each found to consist of four layers of paint - an outermost clear colourless layer, a second brown and orange metallic layer, a third grey layer and a fourth dark grey layer. All four layers of "Item 1" and "Item 3" were found to be similar in terms of colour and chemical composition. The first and second layers of "Item 2" were found to be similar to that of "Item 1" in terms of colour and chemical composition. The third and fourth layers of "Item 2" were found to be different from that of "Item 1" in terms of chemical composition.
AJNYR7	Association Scale for Trace Evidence (Abridged): Level 1 - Identification:, Level 2 - High Degree of Association:, Level 3 - Association: Items are consistent in observed and measured physical properties and/or chemical composition and, therefore, could have originated from the same source. Because other items have been manufactured that would also be indistinguishable from the submitted evidence, an individual source cannot be determined. Level 4 - Limited Association:, Elimination (Non-association): The items were dissimilar in physical properties and/or chemical composition, indicating that they did not originate from the same source.
D3BR3D	Methodology: A stereomicroscope was utilized in the general examination of evidence. A comparison microscope with transmitted light and polarized light capabilities is to compare the physical and optical characteristics of trace evidence materials side-by-side in the same optical field up to 600 times magnification. Images captured with the microscope's digital camera are stored within the laboratory. A Perkin Elmer Spectrum 100 infrared spectrometer (FTIR) with Spotlight 200 microscope accessory is used to analyze the chemical characteristics of materials. A CRAIC Technologies QDI 2010 microspectrophotometer (MSP) is used to measure the relative intensities of visible and UV light that is transmitted, reflected, or fluoresced by a sample. Comparison Terminology Definitions: Indistinguishable: The questioned sample is the same distinct type of material as the known standard based upon observed and measured physical properties and/or chemical composition. In other words, one could not discern a questioned sample if it were to be mixed with an indistinguishable known standard. Similar: The questioned sample is the same distinct type of material as the known standard based upon a limited analysis. Alternatively, one or more variations existed between the questioned sample and the known standard due to factors such as sample heterogeneity, contamination of the sample(s), or having a sample of insufficient size to adequately assess homogeneity of the entity from which it was derived. Dissimilar: Differences in observed and/or measured characteristics were detected. Inconclusive: No conclusion could be reached regarding an association/elimination. Elimination: The items were dissimilar in observed and/or measured characteristics, indicating that they did not originate from the same source.
GCJFL2	Items 1 and 3 comprised at least four layers of: clear lacquer/beige-gold metallic/light grey/dark grey. There were indications of an additional lacquer layer in each. Item 2 could be distinguished from item 1 on the basis of having different grey and dark grey undercoats.

TABLE 4

WebCode	Additional Comments
GHUJHV	<p>Re: The notation "The purpose of this test is the examination of the paint; please ignore the metal substrate" - Automotive metal substrates are not painted in the same manner as this test, making analysis of the e-coat unnecessarily difficult and unrealistic in chemical formation. Also, the scenario states the substrate is a front bumper. These are universally plastic substrates if coated like Item 1 (clear &amp; base coats over a primer system), but with different layer sequences &amp; chemistries than represented by Item 1.</p>
RZGLP9	<p>REMAINDER OF REPORT..... RESULTS: The questioned paint samples recovered from the street lamp (item 1B) and the mailbox (item 1C) were examined for the purpose of determining whether or not they are like the paint on the subject's vehicle (item 1A). The paint standard from the subject's vehicle (item 1A) has the following layer structure: 1. Colorless acrylic-melamine enamel clearcoat, 2. Dark yellow-brown acrylic-melamine enamel basecoat with effect pigment (bronze), 3. Light blue-gray polyester-melamine enamel primer, 4. Dark gray polyester-melamine enamel primer. Item 1A exhibits characteristics typical of an original automotive finish and was used for comparison with the questioned paint samples recovered from the street lamp (item 1B) and the mailbox (item 1C). The questioned paint recovered from the street lamp (item 1B) has the following layer structure: 1. Colorless acrylic-melamine enamel clearcoat, 2. Dark yellow-brown acrylic-melamine enamel basecoat with effect pigment (bronze), 3. Light gray epoxy-polyester enamel primer, 4. Dark gray epoxy-polyester-melamine enamel primer. Examination and comparison of the questioned paint recovered from the street lamp (item 1B) with item 1A revealed they are dissimilar with respect to layers 3 and 4 general binder types and binder characteristics. It is therefore concluded that the questioned paint recovered from the street lamp (item 1B) did not originate from the subject's vehicle represented by item 1A. The questioned paint recovered from the mailbox (item 1C) has the same layer structure as the known paint from the subject's vehicle (item 1A). Examination and comparison of the questioned paint recovered from the mailbox (item 1C) with item 1A revealed they are alike with respect to layer structure, layer colors, layer textures, microchemical reactivities, binder characteristics, and pigment characteristics. It is therefore concluded that the questioned paint recovered from the mailbox (item 1C) is the same distinct type of paint as that on the subject's vehicle (item 1A) and originated either from that vehicle or from another source of automotive paint having the same distinct characteristics. METHODS OF ANALYSIS: Examinations were performed visually, by stereo microscopy, brightfield/polarized light comparison microscopy, microchemical tests, Fourier transform infrared microspectroscopy, pyrolysis gas chromatography, and scanning electron microscopy/energy dispersive x-ray analysis.</p>
TQKALQ	<p>Remark) 1. The term 'source' refers to the specific area of the vehicle from which Exhibit 1 was taken.</p>
WKLQFX	<p>There was a difference in the texture of the primer layer on Item 2. There are also some inconsistencies in the layer thicknesses, especially in the two undercoat layers.</p>



# Appendix: Data Sheet

Collaborative Testing Services - Forensic Testing Program

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## Test No. 15-545: Paint Analysis

DATA MUST BE RECEIVED BY June 01, 2015 TO BE INCLUDED IN THE REPORT

Participant Code:

WebCode:

### Accreditation Release Statement

CTS submits external proficiency test data directly to ASCLD/LAB and ANAB.  
Please select one of the following statements to ensure your data is handled appropriately.

This participant's data is intended for submission to ASCLD/LAB and/or ANAB.  
(Accreditation Release section on the last page must be completed and submitted.)

This participant's data is NOT intended for submission to ASCLD/LAB or ANAB.

### Online Data Entry

Visit [www.cts-portal.com](http://www.cts-portal.com) to enter your proficiency test results online. If you have any questions please do not hesitate to contact CTS.

#### Scenario:

Police are investigating the robbery of a local bank. Witnesses described the getaway car as a dark gray sport utility vehicle. When driving away from the bank, the vehicle struck a street lamp and a mailbox, sustaining damage to the front bumper. When police arrived, they were able to recover paint chips from the scene. Soon after, the police acquired a suspect whose vehicle matched the witness' description and had a damaged front bumper. A known paint sample was taken from the damaged area of the vehicle. Police are requesting that you examine the recovered paint chips and determine if they could have originated from the damaged area of the suspect vehicle.

Please Note:

- Samples contained within each individual item are representative of a single source.
- The purpose of this test is the examination of the paint; please ignore the metal substrate.

#### Items Submitted (Sample Pack P1):

Item 1: Known paint sample representative of the damaged area of suspect vehicle

Item 2: Questioned paint chips recovered from street lamp

Item 3: Questioned paint chips recovered from mailbox

#### 1.) Could the questioned paint chips (Items 2 and/or 3) have originated from the damaged area of the suspect vehicle represented by Item 1?

Item 2:    Yes                       No                       Inconclusive

Item 3:    Yes                       No                       Inconclusive

Please return all pages of this data sheet.



Participant Code:

WebCode:

**2.) Indicate the procedure(s) used to examine the submitted items:**

*Microscopic Examinations:*

Stereomicroscope

Polarized Light

Fluorescence

Pyrolysis GC

FTIR

Solubility/Chemical

XRS/XRF

SEM/EDX

Microspectrophotometry

Other (specify): \_\_\_\_\_

**3.) What would be the wording of the Conclusions in your report?**

\_\_\_\_\_

\_\_\_\_\_

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**4.) Additional Comments**

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<p><b>Return Instructions:</b> Data must be received via online data entry, fax (please include a cover sheet), or mail by <i>June 01, 2015</i> to be included in the report.</p>	<p>Participant Code:</p> <p>ONLINE DATA ENTRY: <a href="http://www.cts-portal.com">www.cts-portal.com</a></p> <p>FAX: +1-571-434-1937 or Toll-Free: 1-866-FAX-2CTS (329-2287)</p> <p>MAIL: Collaborative Testing Services, Inc. P.O. Box 650820 Sterling, VA 20165-0820 USA</p>
<p>QUESTIONS?</p> <p>TEL: +1-571-434-1925 (8 am - 4:30 pm EST)</p> <p>EMAIL: <a href="mailto:forensics@cts-interlab.com">forensics@cts-interlab.com</a> <a href="http://www.ctsforensics.com">www.ctsforensics.com</a></p>	

**Please return all pages of this data sheet.**

## Collaborative Testing Services - Forensic Testing Program

**RELEASE OF DATA TO ACCREDITATION BODIES**

The following Accreditation Releases will apply only to:

Participant Code:

WebCode:

for Test No. **15-545: Paint Analysis**

This release page must be completed and received by **June 1, 2015** to have this participant's submitted data included in the reports forwarded to the respective Accreditation Bodies.

**ASCLD/LAB RELEASE**

If your lab has been accredited by ASCLD/LAB and you are submitting this data as part of their external proficiency test requirements, have the laboratory's designated individual complete the following.

**The information below must be completed in its entirety for the results to be submitted to ASCLD/LAB.**

ASCLD/LAB Legacy Certificate No. \_\_\_\_\_ ASCLD/LAB International Certificate No. \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

Laboratory Name \_\_\_\_\_

Location (City/State) \_\_\_\_\_

**ANAB RELEASE**

If your laboratory maintains its accreditation through ANAB, please complete the following form in its entirety to have your results forwarded.

ANAB Certificate No. \_\_\_\_\_

Signature and Title \_\_\_\_\_ Date \_\_\_\_\_

Laboratory Name \_\_\_\_\_

Location (City/State) \_\_\_\_\_

**Accreditation Release****Return Instructions**

*Please submit the completed Accreditation Release at the same time as your full data sheet. See Data Sheet Return Instructions on the previous page.*

*Questions? Contact us 8 am-4:30 pm EST  
Telephone: +1-571-434-1925  
email: forensics@cts-interlab.com*

**Please return all pages of this data sheet.**

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