Cost-Effective Alternative Methods for Steel Bridge Paint System Maintenance

> A Program Overview and Focus on Eight Field Painting Technologies

> Federal Highway Administration Contract No. DTFH61-97-C-00026

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Presentation Outline

- Objectives
- Approach
- Cost Model
- Technologies
- Comparisons

Objective

- To Identify Methodologies and Technologies that will Reduce the Cost of Bridge Maintenance Painting for Steel Bridge Owners.
 - Compare Technologies by Cost
 - Distribute Program Results

Need for this Study

- Too Many Choices
- Not Enough Money



Many Choices

Surface Preparations

 At least 12 major different Methods

Coatings

At least 10
 different
 generic types

Other Criteria

At least 10
 vital variables



= Thousands of Options



Approach

- Compare "New" Technologies to the Current "State-of-the-Practice"
- Initial Cost is the Main Comparison Criteria
- Cost Model Developed
 - A Comparison Tool
 - Major Project Cost Factors
 - Potential Cost Saving Technologies

Approach (cont.)



Other Project Drivers

Approach (cont.)

- Field Visits and Interviews
 - Real Project Data
 - Mature Work Practices
- Reports Comparing Technologies to the Current-State-of-Practice



Program Overview



The Cost Model - What is it and How Does it Work?

- A Comparison Tool
- User Inputs Project Constraints
- User Selects Painting Options
- Model Quickly Evaluates Process Changes
- Summarizes Data Various Ways

Designed to provide activity-based cost estimates Allows alternative technology comparisons Validated through field observations Fully adjustable cost factors (e.g. for regional labor differences) Default data is based on this study

Cost Model Calculations

- Creates a Time Estimate Based on User Inputs
 - Mobilization-Demob Time / Containment Time / Surface Preparation Time / Painting Time
- Estimates Project Materials
 - Abrasive / Water Usage
 - Paint Required
 - Waste Produced
- Compiles Estimate Based on Unit Cost Factors

Project Constraints Bridge Square Footage Percent Area Deteriorated Lead in Coating Containment / Staging Labor Rates / Workday Duration

Project Constraints

					ltem		Input
		Cost Effective Altern	ate Methods for FHWA Contract No	Steel Bridge Paint System Maintenance D. DTFH61-97-C-00026	Bridge Square	Footage	25,000
Cost Model Input F	Page						
Use this page to input va	arious paint	ting options. View model results	on the "Output" page.	Compare various options with the "Comparison Page"_			
		A variable input parameter					
		An input selection					
Item	Input	Description					
Bridge Square Footage	25,000	The paintable square footage (S	F) of the bridge. Sugg	ested minimum is 5,000. A "typical" 2-lane bridge over	norcont dotoric	ratad	10 00/
					percent detent	Jaleu	10.076
		The percent area of the paintable	e area that is corroded	I through the coating. Typical deterioration for an overco	at project is less than 10%.		
percent deteriorated	10.0%	Deterioration greater than 10% is	s seen on some paint	removal projects. Deterioration over 25% may slow clear	aning		
Forman	1	The number of crew foremen wo	rking this project. Typ	ically one.			
Blaster/Painter	4	The total number of blasters and	painters working this	project. Typically four to six.			
Helper	2	The total number of helpers or a	oprentice workers for t	his project. Typically one to three.			
		The weighted average hourly lab	or rate for the total of a	all Foremen, Painters, and Helpers. This varies by regio			
Average Labor Rate	\$ 30.00	26 blas an approximate mediai	n number.				
Hours/Day	10.0	The number of hours the cross and	erke each day. Varies	s by hours crew is provided access to the jobsite. Avera	Auranalaha		¢ 00.00
Lead in coating	Yes	Select if the existing coating co	ntains lead. This relat	es mostry to access and LH&S costs.	Average Labol	r Rate	\$ 30.00
Washing	Voc	Select II a pre-wash of the bridge	e is required prior to a	aditional surface preparation. This is a low pressure			
Dehumidification	No	Select if the contained area will	be debumidified		Hours/Dav		10.0
Protox	No	Select if lead is in the costing a	od a pro applied load o	tabilizar will be used	riouro, Buy		10.0
Blastov	Vec	Select if lead is in the coating a	nd an abrasive additive	will be used	Lood in opatin	~	Voo
Ranid Denlovment	No	Select if a rapid deployment set	un and schedule are t	in he used	Leau III Cualing	y	I ES
Strine Coat	Yes	Select if a strine coat is applied	(default is yes)				
Full Removal Surface	Preparatio	Select a single surface preparat	ion method from the c	hoices below. Each option has an associated productio	n rate.		
	1	Preparation Method	Production Rate	Description			
		0. Spot-Sweep Preparation					
		. , ,		Benchmark removal method for this study. Common r	emoval rate is 100 SF/MH. Typical		
		1. Once Through Abrasive	10	o range may be from 50 to 250 SF/MH.			
				Direct current removal method for coatings over steel.	Rate of 40 SF/MH is from this		
		2. ElectroStrip	4	o study. Estimated production range may be from 20 to	100 SF/MH.		
				Products like "Metgrain." Removal rate of 200 is average	ge for sites visited in this study.		
		3. Recyclable Steel Grit	20	0 Typical range may be from 50 to 250 SF/MH.			
				Ultra-High pressure water jetting using hand held lance	es. Rate of 100 SF/MH is an average		
		4. Water Jetting	10	of 3 site visits. Typical range may be from 75 to 150 S	F/MH.		
				Variable pressure water jetting with abrasive injection.	Rate of 100 SF/MH is from this		
		5. Grit Injected Water Jetting	10	o study. Typical range may be from 75 to 150 SF/MH.			
		6. Torbo Wetblast System	9	Production rate of 91 is from this study. Typical range	e may be from 50 to 200 SF/MH.		

Project Operating Parameters Full Removal or Spot Surface Preparation

Productivity for each option

Staging and Containment Selection with adjustable "time factors"

Coating System Options

Two or Three Coat Sys Project Operating Parameters **Application Methods**

	Cost Effective Altern	ate Methods for	Steel Bridge Paint	t System Maintenance	
		FHWA Contract No	. DTFH61-97-C-00026		
Cost Model Input Page					
Full Removal Surface Preparation	or Select a single surface preparati	on method from the cl	noices below. Each op	Droporation Mathed	Draduction Data
	1 Preparation Method	Production Rate	Description	Preparation Method	Production Rate
	0. Spot-Sweep Preparation			0 Spot Supon Propagation	(SE per Man-hour)
			Benchmark removal r		(er per man near)
	1. Once Through Abrasive	100	range may be from 50		
	2 ElectroStrip	Α	Direct current remova		
	2. ElectroStrip	4(Broducto liko "Motors	1 Once Through Abrasive	100
	2 Pocyclabla Stool Crit	20(Two or page may be	1. Onee milough Abrushe	100
	S. Necyclable Steel Gill	200	Liltra-High pressure		
	4 Water Jetting	100	of 3 site visits. Typica		
	4. Water betting	100	Variable pressure wa	2. ElectroStrip	40
	5. Grit Injected Water Jetting	100	study. Typical range		
	6. Torbo Wetblast System	9'	Production rate of 91		
Spot-Sweep Surface Preparation	n Select a single surface preparati	on method from the ch	noices below. Each op		
	0 Preparation Method	Production Rate	Description	3. Recyclable Steel Grit	200
	0. Full Removal Preparation			L	
			Benchmark spot prep	paration method for this study. Typical production rate is 10 SF/MI	1
			for cleaning of "spots	only. These numbers vary greatly depending upon the condition of	of
	1. Hand Tool Cleaning	1(the bridge.		
			Calculation based on	Staging/Containment Option	Hours nor location
	2. Water Jetting	172.73	3 2.6371*Deterioration+	Staging/Containment Option	nours per location
	3. Brush Blast (expendable grit)	189.40	Calculation based on		
	4. Grit Injected Water Jetting	189.40	Calculation based on		
	5. Recyclable Steel Grit	200	Rate to sweep all su		
	6. Water Injected Blasting (Tord	150	Rate to sweep ar sur		
Staning/Osetainmant Ontions	7. Vacuum Blasting	80 Signa ant antian from th		1 Lift Trucks	0.75
Staging/Containment Options	1 Staging/Containment Ontion		Deseriation		0.70
	Staging/Containment Option	nours per location	Letterucks are a com	2 Safe-Span Platform	200
			are the hours requi		200
	1. Lift Trucks	0.75	study = .75 hrs.)	3. Suspended Rigid Platform	320
	2. Safe-Span Platform	200	Enter SF built by the		
	3. Suspended Rigid Platform	320	Enter SF built by the	entire crew per hour. (This study = 320 SF/hr.)	
	4. ARK Mobile Platform System	0.5	Hours required to set	-up and remove an ARK platform per shift (This study = .5 hrs.)	
Coating System Options	Select a single Coating System	from the choices belo	W.		
<u> </u>	1 Coating System Type	Description			
	1. Three Coat System	Primer over bare met	al plus two full coats		
	2. Two Coat System	Primer over bare met	al plus one full coat		

Spot Preparation Production Rates



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Advanced Cost Variables Cost Information Examples Equipment Costs Material Costs Environmental Health and Safety Costs Spot Preparation Production Rates

Cost Variables

- Over 140 Variable Inputs
- Contains Default Information
 - Surface Preparation Equipment Costs
 - Staging / Containment Equipment Costs

- Material Costs, Usage Rates
- Disposal Costs
- Lead Health and Safety Costs
- Operating Cost Factors

Calculates Total Cost, Cost per Year, and Cost per 9-month period

Equipment Costs

Background variables page - Use	this page	e <u>to vary t</u> l	he calcula	ition parame	ters fo	r the c	ost model						
		= a change	able input pa	arameter									
		Service	Discount				Cost per month						
Surface Preparation Equipment Costs	Initial Cos	t Life (yrs)	Rate	Total Cost	Cost pe	er vear	(9 month year)	Notes					
Recyclable Steel Grit Rig - 4 outlet	\$ 240,000) 5.0	7%	\$ (336,612.42)	\$ (67,3	322. jõj	(7,480.28)						
UHP (10 G/) - 2 outlet	\$ 200,000) 5.0	7%	\$ (280,510.35)	\$ (56,	102.07)	\$ (6,233.56)						
WJ Crawler/w vac.	\$ 200,000) 5.0	7%	\$ (280,510.35)	\$ (56,7	102.07)	\$ (6,233.56)						
UHP (6 GPVI) - 2 outlet	\$ 135,000	5.0	7%	\$ (189,344.48)	\$ (37,8	868.90)	9					Coct	oor month
Compressor - to 3 crewmen	\$ 75,000	5.0 5.0	7% 70/	\$ (105,191.38)	\$ (21,0	038.28)	3 a					C031	
GIU DIAST DI - 4 DUIEL	<u>.</u> 70.000	5.0	170		א דו איז דיי <u>י</u>	Sei	Total (Cost	Co	ost per y	year	(9 mo	onth year)
Surface Dreneration Fe			-1-		t		\$ (336.6	12 42) \$	(67.32)	2 48)	\$	(7.480.28)
Surface Preparation Ed	luibme	ent Co	STS	Initial C	ost	LITE	¢ (888,8			(07,022		Ψ •	
Recyclable Stee	el Grit	Rig - 4	outlet	\$ 240,0	000		\$ (280,5	510.35) \$	(56,102	2.07)	\$	(6,233.56)
UHP	(10 GF	PM) - 2	outlet	\$ 200.0	000		5.0		7%				
Convention Sprayer	⊅ 1,7ວ0	/ 0.0	1 70	৵ (∠,4ა4.০১)	φ ('	400.97)	ې ۱۹.۱۱)						
Generator (2.25 kW) - for 6 crewmen	\$ 1,000	50	70/_	¢ (1 402 55)	¢ /'	280 51)	¢ (21 17)						
Moister Separator	\$ 725										Ser	vice	Discount
Blast Hoods B-88's	\$ 628		10	_									_
						-							
Misc. Hand Tools	\$ 3,850	Stagi	ng/Cor	ntainme	nt E	quip	ment Cos	sts I	niti	al Cost	Life	(yrs)	Rate
Misc. Hand Tools Vacuum Blast Rig - 4 outlet	\$ 3,850 \$ 96,25	Stagi	ng/Cor	ntainme	nt E	quip	ment Co	sts I	niti ¢	al Cost	Life	(yrs)	Rate
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck	\$ 3,850 \$ 96,250 \$ 65,000	Stagi	n g/Cor Ark S	n tainme System (2	nt E 2 cre	quip wme	ment Cos en per sec	sts I tion)	niti \$	al Cost 14,500	Life	(yrs) 5.0	Rate 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork	\$ 3,850 \$ 96,250 \$ 65,900 \$ 24,000	Stagii	n g/Cor Ark S	n tainme System (2	nt Eo 2 cre Arl	quip wme k Ove	ment Cos en per sec erpass Ma	sts l tion) aster	niti \$ \$	al Cost 14,500 74 900	Life	(yrs) 5.0 5.0	Rate 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen	\$ 3,850 \$ 96,250 \$ 65,000 \$ 24,000 \$ 25,000	Stagii	n g/Cor Ark S	n tainme System (2	nt Eo 2 cre Arl	quip wme k Ove	ment Cos en per sec erpass Ma	sts tion) aster	niti \$ \$	al Cost 14,500 74,900	Life	(yrs) 5.0 5.0	Rate 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen	\$ 3,850 \$ 96,259 \$ 65,000 \$ 24,000 \$ 25,000	Stagin	n g/Cor Ark S	n tainme System (2 L	nt Eo 2 cre Arl _ift Tr	quip wme k Ove ruck	ment Cos en per sec erpass Ma for 4 crew	sts tion) aster men	niti \$ \$ \$	al Cost 14,500 74,900 70,000	Life	(yrs) 5.0 5.0 5.0	Rate 7% 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen Days / month used to cost out equip	\$ 3,850 \$ 96,259 \$ 65,000 \$ 24,000 \$ 25,000	Stagin	n g/Cor Ark S	n tainme System (2 L	nt Eo 2 cre Arl .ift Tr	quip wme k Ove ruck	ment Cos en per sec erpass Ma for 4 crew	sts tion) aster men	niti \$ \$ \$ \$	al Cost 14,500 74,900 70,000	Life	(yrs) 5.0 5.0 5.0	Rate 7% 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen Days / month used to cost out equip	\$ 3,850 \$ 96,259 \$ 65,000 \$ 24,000 \$ 25,000	Stagin	n g/Cor Ark S	n tainme System (2 L	nt Eo 2 cre Arl _ift Tr	quip wme k Ove ruck	ment Cos en per sec erpass Ma for 4 crew Dust Colle	sts tion) aster men ector	niti \$ \$ \$ \$	al Cost 14,500 74,900 70,000 75,000	Life	(yrs) 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen Days / month used to cost out equip	\$ 3,850 \$ 96,259 \$ 65,000 \$ 25,000 16 Initial Cos	Stagin	ng/Cor Ark S	ntainme System (2 L	nt Eo 2 cre Arl _ift Tr	quip wme k Ove ruck	ment Cos en per sec erpass Ma for 4 crew Dust Colle (9 month year)	sts tion) aster men ector	niti \$ \$ \$ \$	al Cost 14,500 74,900 70,000 75,000	Life	(yrs) 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen Days / month used to cost out equip Staging/Containment Equipment Costs ARK System (2 crewmen per section)	\$ 3,850 \$ 96,259 \$ 65,000 \$ 25,000 \$ 25,000 \$ 160 \$ 14,500 \$ 14,500	t Life (yrs) 5.0	ng/Cor Ark S ^{Rate}	tainme System (2 L Total Cost \$ (20,337.00)	nt Ed 2 cre Arl Lift Tr	quip wme k Ove ruck ar year 067.40)	ment Cos en per sec erpass Ma for 4 crew Dust Colle (9 month year) \$ (451.93)	sts tion) aster men ector Notes	niti \$ \$ \$ \$	al Cost 14,500 74,900 70,000 75,000	Life	(yrs) 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen Days / month used to cost out equip Staging/Containment Equipment Costs ARK System (2 crewmen per section) Ark Overpass Master	\$ 3,850 \$ 96,25 \$ 65,000 \$ 25,000 \$ 25,000 \$ 16 Initial Cos \$ 14,500 \$ 74,900	t Life (yrs) 5.0 5.0	Ark S Rate 7% 7%	tainme System (2 L Total Cost \$ (20,337.00) \$ (105,051.12)	nt Ec 2 cre Arl .ift Tr \$ (4,(\$ (21,(quip wme k Ove ruck er year 067.40) 010.22)	ment Cos en per sec erpass Ma for 4 crew Dust Colle (9 month year) \$ (451.93) \$ (2,334.47)	sts tion) aster men ector Notes	niti \$ \$ \$ \$	al Cost 14,500 74,900 70,000 75,000	Life	(yrs) 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen Days / month used to cost out equip Staging/Containment Equipment Costs ARK System (2 crewmen per section) Ark Overpass Master Lift Truck for 4 crewmen	\$ 3,850 \$ 96,25 \$ 65,000 \$ 25,000 \$ 25,000 \$ 14,000 \$ 14,500 \$ 74,900 \$ 70,000	t Life (yrs) 5.0 5.0 5.0 5.0	Rate 7% 7% 7%	Totainme System (2 L \$ (20,337.00) \$ (105,051.12) \$ (98,178.62)	nt Ec 2 cre Arl ift Tr \$ (4,0 \$ (21,0 \$ (19,6	quip ewme k Ow ruck ar year 067.40) 010.22) 635.72)	ment Cos en per sec erpass Ma for 4 crew Dust Colle (9 month year) \$ (451.93) \$ (2,334.47) \$ (2,181.75)	sts tion) aster men ector Notes	niti \$ \$ \$ \$	al Cost 14,500 74,900 70,000 75,000	Life	(yrs) 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen Days / month used to cost out equip Staging/Containment Equipment Costs ARK System (2 crewmen per section) Ark Overpass Master Lift Truck for 4 crewmen Dust Collector	\$ 3,850 \$ 96,25 \$ 65,000 \$ 25,000 \$ 25,000 \$ 25,000 \$ 14,500 \$ 74,900 \$ 76,000 \$ 75,000	t Life (yrs) 5.0 5.0 5.0 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7%	Total Cost \$ (20,337.00) \$ (105,051.12) \$ (98,178.62) \$ (105,191.38)	nt Ec 2 cre Arl ift Tr \$ (4,(\$ (21,(\$ (19,6 \$ (21,(quip ewme k Ow ruck of year 067.40) 010.22) 635.72) 038.28)	ment Cos en per sec erpass Ma for 4 crew Dust Colle (9 month year) \$ (451.93) \$ (2,334.47) \$ (2,334.47) \$ (2,337.59)	sts tion) aster men ector Notes	niti \$ \$ \$ \$	al Cost 14,500 74,900 70,000 75,000	Life	(yrs) 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7%
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Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen Days / month used to cost out equip Staging/Containment Equipment Costs ARK System (2 crewmen per section) Ark Overpass Master Lift Truck for 4 crewmen Dust Collector D/H Unit Rigid platform staging (plywood)	\$ 3,850 \$ 96,25 \$ 65,000 \$ 25,000 \$ 25,000 \$ 14,500 \$ 74,900 \$ 77,900 \$ 75,000 \$ 25,200 \$ 1.00	t Life (yrs) 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7% 7%	Total Cost System (2 L \$ (20,337.00) \$ (105,051.12) \$ (98,178.62) \$ (105,191.38) \$ (35,344.30) naterials, set up	nt Ec 2 cre Arl ift Tr \$ (4,(\$ (21,(\$ (19,6 \$ (21,(\$ (7,(with unit	quip wme k Ow ruck off off off off off off off of	ment Cos en per sec erpass Ma for 4 crew Dust Colle (9 month year) \$ (451.93) \$ (2,334.47) \$ (2,337.59) \$ (785.43) nts of 5,000 SF.	sts tion) aster men ector Notes	niti \$ \$ \$ \$	al Cost 14,500 74,900 70,000 75,000	Life	(yrs) 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7%
Misc. Hand Tools Vacuum Blast Rig - 4 outlet Vacuum Truck Decon Trailer - for leadwork Truck MPT/Towing for 4 crewmen Days / month used to cost out equip Staging/Containment Equipment Costs ARK System (2 crewmen per section) Ark Overpass Master Lift Truck for 4 crewmen Dust Collector D/H Unit Rigid platform staging (plywood) SafeSpan System	\$ 3,850 \$ 96,25 \$ 65,000 \$ 25,000 \$ 25,000 \$ 14,500 \$ 74,900 \$ 74,900 \$ 74,900 \$ 75,000 \$ 25,200 \$ 1.00	t Life (yrs) 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	Rate 7% 7% 7% 7% e platform m fespan is cal	Total Cost \$ (20,337.00) \$ (105,051.12) \$ (98,178.62) \$ (105,191.38) \$ (35,344.30) haterials, set up culated based of	nt Ec 2 cre Arl ift Tr \$ (4,0 \$ (21,0 \$ (19,6 \$ (21,0 \$ (19,6 \$ (21,0) \$ (7,0) \$ (7,0)	quip wme wme k Ow ruck ruck of7.40) o10.22) 635.72) o38.28) o68.86) increme ife span	ment Cos en per sec erpass Ma for 4 crew Dust Colle (9 month year) \$ (451.93) \$ (2,334.47) \$ (2,334.47) \$ (2,337.59) \$ (785.43) nts of 5,000 SF. ental schedule loc	sts tion) aster men ector Notes	niti \$ \$ \$ \$	al Cost 14,500 74,900 70,000 75,000	Life	(yrs) 5.0 5.0 5.0	Rate 7% 7% 7% 7%

Material Costs

Material Costs											
	cost	/unit	unit						C	ost/unit	unit
Steel Grit	\$	300	Ton				S	tool Crit	¢	300	Ton
Slag Grit	\$	60	Ton				5	leel Gill	Ψ	300	1011
Grit with Blastox Pretox	\$ \$	148 19.95	Ton Gallon <				S	Slag Grit	\$	60	Ton
Water	\$	0.027	Gallon				Grit with	Blastox	\$	148	Ton
Paint	\$	30.00	Gallon					D	۰ ۲	40.05	
Fuel	\$	1.30	Gallon		h l			Pretox	\$	19.95	Gallon
Other Misc. Items	\$	200	Day (misc	c. sundries ea	ach day)			Water	\$	0.027	Gallon
								Delint	Å	20.00	Caller
Material Use/Application Rates								Paint	Ф	30.00	Gallon
Destau Application Date		2 000	05/14					Fuel	\$	1.30	Gallon
Pretox usage rate		3,000	SF/ml	The ideal sr	preading rate at t	ne specified W/	FT				
PreTox dry density		8 28	lh /gal	density of d	Iried Pretox used	in waste tonna	ne calculation				
LPWC Production Rate		600	SF/Hr								
Stripe Coat Production Rate		2.600	Edges in 3	SF shown / H	-lr						
RSG usage rate		0.50	lb./SF	This is the a new RSG is accurate nu	average RSG cor s specified for a p imber.	sumption rate roject this sho	for the project NOT uld be higher, if new	the amount ne RSG is not sp	eded to becified	clean each SF I .5 lb./SF is an	. lf
Once Through Slag usage rate		10.00	lb./SF	Average nee	eded to clean ead	ch SF					
UHP water usage rate		3	GPM	1.80	gal/SF full remo	1.04	gal/SF spot work				
LPWC usage rate		0.15	gal/SF								
Water with Grit injection - Water use		0.123	gal/SF								
Water with Grit injection - Grit use		1.00	lb./SF								
Grit blast with Water injection - Grit use		3.00	lb./SF								
Grit blast with Water injection - Water use		0.12	gal/SF								
Vacuum Blast grit use rate		1.00	lb./SF	This is the g	grit consumption crease this amou	rate for the pro int, otherwise 1	ject NOT the amoun lb./SF is a reasona	nt needed to cl able average co	ean ea onsump	ch SF. If new gr otion.	it is
		400	SF/gal	The ideal spreading rate at the specified WFT							
Paint usage rate				For all equipment at the jobsite							

Environmental Health and Safety Costs

Pre-Existing Conditions										
Existing Paint DFT	15.00	mils	Thickn	ess of the existing pa	aint to be remove	ed. Default value	is 15 mils.			
Existing Paint Specific Gravity	2.50	ratio	Specif	ic aravity of the existi	na coatina to be	removed. Typic	al values rand	nont ac	n 1.8 to 2.8. De	fault is 2.5
				Disposal Cos	t Factors					
Disposal Cost Factors				Barrel for	solid wast	e disposal	\$ 30	00	each	
Barrel for solid waste disposal	\$ 30.00	each		Barrorior	cond made		φ 00	.00	odon	_
Hazardous material disposal	\$ 180.00	ton		Hazard	ous materia	al disposal	\$ 180	.00	ton	
Non-hazardous material disposal	\$ 60.00	ton	Non hozardous material disposal				¢ 60	00	ton	
Wash water disposal	\$ 0.10	gallon		INUITHAZAIU	ous materia	ai uispusai	φ 00	.00	lon	
					Wash wate	er disposal	\$ 0	.10	gallon	
Lead Health and Safety Costs										-
Lead Health and Safety Plan	\$ 500.00	dollars	Variab	le input depending up	on size and con	nplexity of Project	:t			
Site Pre-Assessment	\$ 500.00	dollars	Variable input depending upon size and complexity of Project							
High Vol. Air Monitoring	\$ 50.00	dollars	Price per day for HV monitoring. If lead is present = applies to full duration, If no lead = applies to S Prep ti							
Field Tech./Emissions Observer	\$ 75.00	dollars	Price per day for field tech. If lead is present = applies to full duration, If no lead = applies to Surface Prep t							
Lab Testing of Samples	\$ 100.00	dollars	Price p	per day for sample tes	sting. If lead is p	present = applies	to full durati	on, lf n	io lead = applies	s to Surface
Post Site Assessment	\$ 500.00	dollars	Variab	le input depending up	on size and com	plexity of Project	:t			

Cest Model Spreadsheet - Results Page For a Bridge Project with: 25 000 Paintable Square Feet 10.0% Percent Area Deteriorated 7 Persons in the Work Crew The Costs to: Full removal with once through abrasive Contentional spray apply a three cost system are given below. Labor Cost Storest Store			
or a Bridge Project with: 2000 Plantable Square Feet 10.0% Percent Area Deteriorated 7 Percent Area Deteriorated 7 Percent Area Deteriorated 7 Percent Area Deteriorated 8 Contain using Lift Trucks Conventional spray apply a three coat system re given below. Labor Cost Waste Disposal 8 Staging and Containment Project Insurance 9.04% 9.04% 9.04% 9.04% 9.04% 1 Staging and Containment 9.04% 9.04% 1 Staging and Containment 9.04% 1 Staging and Containment 1 Staging and Containment 9.04% 1 Staging and Containment 1 Staging and Containment 9.04% 1 Staging and Containment 9 Project Insurance			
ar a Bridge Project with: 22,000 Paintable Square Feet 10.0% Percent Area Deteriorated 7 Persons in the Work Crew ie Costs to: Full removal with once through abrasive Conventional spray apply a three cost system a given below. Labor Cost Waste Disposal Project Insurance Project Cost Analysis			
25.000 Paranable Square Feet 10.0% Persons in the Work Crew Costs to: Persons in the Work Crew Contentional spray apply a three coat system Select below to send results Conventional spray apply a three coat system Select below to send results Generation using Lift Trucks Conventional spray apply a three coat system Guide below. Item Cost Waste Disposal \$ 33,521.25 Staging and Containment \$ 10,117,42 A Heariats \$ 205,552.20 Project Cost Analysis Copy as "Option 2" Project Cost Analysis Copy as "Option 2" 13.04% \$ 10,117,42 9.04% 9.04%			
10.0% Percent Area Deteriorated 7 Persons in the Work Crew S Poil removal with once through abrasive Select below to send results Contain using Lift Trucks Item Contain using Lift Trucks Select below to send results Conventional spray apply a three coat system Select below to send results given below. Item Cost Waste Disposal S 3 3252/31 / 25 161.51 0/4/35 / 2.90 Materials 2.9185.05 904/35 10/7 / 24 .422% Production Equipment 8.208.58 10.552.20 100% Staging and Containment 8.208.58 Project Cost Analysis 100% 13.04% 100% 4.92% 2.04.04 3.99% 3.030 9.04% 0.04% 9.04% 0.04% 9.04% 0.04% 9.04% 0.04% 9.04% 0.04% 9.04% 0.04% 9.04% 0.04% 9.04% 0.04% 9.04% 0.04% 9.04% 0.04%			
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9.04%	29,185.05	14.20%	\$ 1.1
Staging and Containment Project Insurance			
Project Insurance			
14.20% 16.31%			

1.34

1.17

Cost Effective Alternate Methods for Steel Bridge Paint System Maintenance									
FHWA Contract No. DTFH61-97-C-00026									
	Option 1		Optio	on 2	Optic	on 3			
Labor Cost	\$	2.68	\$	3.15	\$	3.15			
Waste Disposal	\$	0.15	\$	1.95	\$	0.01			
Materials	\$	0.49	\$	0.74	\$	0.37			
Production Equipment	\$	1.11	\$	0.94	\$	0.75			
Lead Health and Safety	\$	0.27	\$	0.30	\$	0.30			
Staging and Containment	\$	0.40	\$	0.40	\$	0.28			
Project Insurance	\$	0.30	\$	0.45	\$	0.29			
Profit	\$	0.81	\$	1.19	\$	0.77			
Total Cost	\$	6.20	\$	9.13	\$	5.93			



Painting Comparisons

- Unit Cost Comparisons
 - RSG
 - Once Through Grit
 - SP-3 (Spot Power Tools)
 - Bridge with 20,000 SF, 10%
 Deterioration, 7-Person Crew

- Hand Tools \$5.93
- Slag Grit \$9.13
- RSG \$6.20

The "Alternative Methods"

- Technologies and our Field Visits
 - Cost of Specific Items
 - Performance of Specific Methods
- Investigated 8 Field Technologies at over 25 Job Sites
 - Produced a Separate Report for Each Technology

Reports

- ElectroStrip
- Abrasive Injected Water Blasting
- Rapid DeploymentSM
- Recyclable Steel Grit
- TorboTM System

- Lead Stabilizers

 (Abrasive Additive and Pre-applied Coating)
- Water Jetting
- Metallizing
- Adhesive Foil

All are Available through the Advisory Council Web Site, Corrpro, or the FHWA



ElectroStripTM

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- Applicable to "Small" Areas
- No Dust
- Needs High-Ampere DC Electric Source
- Relatively Slow Production (40-60 Ft²/Hr.)
- Supplement with Hand Tool Cleaning

Cost Comparison for ElectroStrip[™] vs. Abrasive Blasting



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Abrasive Injected Water Blasting (AIWB)

- 4 kpsi Grit Injected Waterjetting in VA
- Productivity Dependent Upon Deterioration
- Comparison vs. Hand-tool Spot Preparation
- No Dust
- Must Contain Water

AIWB vs. Hand Tools





- Work is Performed in Manageable Sections that are <u>COMPLETED</u> Each Night
- Use Quick Cure Coatings
 - -2 coats + Stripe Coat
- Reduced Inconvenience to Travelling Public

• Substantial Coordination Required

Conventional Operations





Recyclable Steel Grit

- Less Dust Than Disposable Abrasives
- Larger Equipment Costs
- Less Waste Generated
- Higher Pressure = Better Production



Cost Comparison of Recyclable Steel Grit vs. Expendable Abrasives





TorboTM System

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- Low Dusting
- Operator Control of "Mixture"
- Must Rinse Surfaces After Preparation
- Collection of Slurry

Cost Comparison for Torbo vs. Dry Grit



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Lead Stabilizers (Abrasive Additive and Pre-applied Coating)

- Lower Disposal Costs
- Possible Extra Application
- Greater Material Costs
- Slight Savings Overall

	Cost		% Savings
regular disposal	\$	10.34	0%
pre-applied	\$	10.12	2%
blended abrasive	\$	10.13	2%



Waterjetting

- Higher Equipment Costs
- Cleans Contaminants from the Surface
- Currently used for Spot Prepare and Paint
- Does NOT Generate Profile
- Water Disposal Required
- Low Dust / High Mist

Cost Comp. of Waterjetting vs. Hand/Power Tool Cleaning





Metallizing

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- Higher Equipment Costs
- Higher Material Costs
- Slower Production
- Single Application
- Superior Coating Durability

Cost Comparison of 3-Coat Painting to Metallizing



Modular Containment/Staging



• Lift trucks in VA/NJ



Modular Containment/Staging

• SafeSpan





Technology Comparisons

- Quantitative by Cost
- Qualitative by Other Factors



Spot Preparation Methods





Full Removal Methods



Other Technologies





RSG / 3-coat



Things to Consider

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- Review Objectives
- Understand Constraints
- Technical Durability Estimates
- Cost Estimates
- "Management Approval"

Maintenance Objectives and Constraints

- Aesthetics
- Durability
- Structural Integrity
- Environmental Objectives

- Fit the "Master Plan?"
 - Corridor Development

- Basic Maintenance
- Bridge Upgrades
- Cost / Economics
- Learning Curves

Technical Considerations

• Durability

 Surface Preparation Directly Related to Coating Performance

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- Painting
 - Material Types
 - Number of Coats
 - Thickness
 - Other Materials

Putting It All Together

- Constraints Filter the Choices to a Manageable Number of Options
- Cost Estimate for Each Option
- Durability Estimate for Each Option
- What Color?

