

Tunnel Systems Cost Estimates

Two-Lane Reversible EJMT Alternatives

Alt01: 2 Rversible Lanes

Lanes	2 @ 12'
Shoulders	2 @ 10'
Vertical Clearance	18.5'
Tunnel Radius	26'
Face Area, ft2	1374
Length, ft	8700
CPs	13

Project Category	Scope Element	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
SCADA	FACP	\$ 100,000	2	\$ 200,000	Duplicate FACP for Alternate control point
	Manual fire alarms	\$ 5,000	32	\$ 160,000	Spaced at 275 ft
	LHD cabling and controls	\$ 100	8,700	\$ 870,000	
	Signal wire cable	\$ 50	17,400	\$ 870,000	Allowance for return loop
	Traffic monitoring CCTV	\$ 5,000	66	\$ 330,000	Cameras at 140' OC, one camera per location
	VIDS software	\$ 100,000	1	\$ 100,000	
	VID servers	\$ 20,000	22	\$ 440,000	Allow 3 CCTV cameras per VID server
	Traffic signals	\$ 200,000	2	\$ 400,000	Signals at east and west portals
	Tunnel LED DMS	\$ 270,000	17	\$ 4,590,000	Increase unit price to allow for two-sided, two-line, 24' wide DMS
	Operating systems software	\$ 600,000	1	\$ 600,000	Added cost for increased complexity of operation
	OS Servers	\$ 20,000	15	\$ 300,000	
	Air quality monitoring equipment (CO and NO)	\$ 50,000	15	\$ 750,000	Sensors at 600' OC
	Access control and intrusion detection	\$ 10,000	26	\$ 260,000	CP doors
	Control room console and video wall	\$ 250,000	1	\$ 250,000	Allowance for large video wall
	Operator workstations	\$ 10,000	4	\$ 40,000	
	OS Servers	\$ 10,000	6	\$ 60,000	
	Racks, cabinets, conduit, conductors	\$ 20,000	23	\$ 460,000	Added racks in CPs
	SCADA Software	\$ 200,000	2	\$ 400,000	Allow for ~2x number of points
	Acceptance Testing/Commissioning	\$ 400,000	2	\$ 800,000	Allow for ~2x number of points
TOTAL SCADA				\$ 11,880,000	
Ventilation	Tunnel ventilation fans	\$ 4	1,915,000	\$ 7,660,000	Add 1.5 x to account for elevation, 90% efficiency for reversed fans
	Conduits and conductors	\$ 100	8,700	\$ 870,000	
TOTAL VENTILATION				\$ 8,530,000	
Cross Passages	Smoke control ventilation system	\$ 100,000	13	\$ 1,300,000	Based on CP count
	Lighting	\$ 10,000	13	\$ 130,000	
	Conduits and conductors	\$ 20,000	13	\$ 260,000	

Project Category	Scope Element	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
TOTAL CROSS PASSAGES				\$ 1,690,000	
Fixed Fire Suppression	Water supply, tanks	\$ 100,000	1	\$ 100,000	
	Pressurization pumps	\$ 10,000	2	\$ 20,000	
	Recirculation pump and boiler	\$ 100,000	1	\$ 100,000	
	Wet standpipe, sprinklers, controls	\$ 1,000	8,700	\$ 8,700,000	
	Pump control panel	\$ 10,000	1	\$ 10,000	
	Isolation valves	\$ 1,000	44	\$ 43,500	
	Cabinets	\$ 10,000	2	\$ 20,000	
TOTAL FIRE SUPPRESSION				\$ 8,993,500	
Standpipe	Water supply, tanks	\$ 100,000		\$ -	
	Pressurization pumps	\$ 100,000	2	\$ 200,000	
	Recirculation pump and boiler	\$ 100,000	2	\$ 200,000	Recirculation pump and heat at both portals
	Wet standpipe	\$ 300	8,700	\$ 2,610,000	
	Jockey pump	\$ 50,000	-	\$ -	Not required due to elevation of water source
	Pump control panel	\$ 30,000	2	\$ 60,000	Allowance for 2 pump rooms
	Fire Hose Valves	\$ 2,000	32	\$ 64,000	Spaced at 275' OC
	Isolation valves	\$ 2,000	64	\$ 128,000	2 per fire hose valve
	Cabinets	\$ 10,000	32	\$ 320,000	Cabinets at FHV
TOTAL STANDPIPE				\$ 3,582,000	
Lighting	Light fixtures	\$ 400	8,700	\$ 3,480,000	
	Conduits and conductors	\$ 100	8,700	\$ 870,000	
	Photocell controllers	\$ 2,000	4	\$ 8,000	
TOTAL LIGHTING				\$ 4,358,000	
Power	Switchgear	\$ 500,000	6	\$ 3,000,000	Increase unit price to account for increased connected load
	Generator	\$ 200,000	2	\$ 400,000	Emergency loads only
	Ventilation MCCs	\$ 30,000	48	\$ 1,440,000	
	Transformers	\$ 200,000	20	\$ 4,000,000	Add transformers (13 kV/4160 V) at 7 CPs for vent fan motor power
	Conduit/raceways, conductors	\$ 500	8,700	\$ 4,350,000	Added cost for 13 kV circuits through tunnel)
TOTAL POWER				\$ 13,190,000	
Communications	Fiber optic outside plant (conduit and fiber cable)	\$ 100	8,700	\$ 870,000	Include loop through Bore 2
	Splice vaults	\$ 20,000	20	\$ 400,000	Allow 1 splice vault per CP
	Switches, patch panels	\$ 20,000	24	\$ 480,000	
	Cabinets	\$ 10,000	22	\$ 220,000	
	Emergency telephones	\$ 2,000	32	\$ 64,000	
	Emergency frequency radio rebroadcast	\$ 768,000	1	\$ 768,000	
	Data links to control center	\$ 10		\$ -	
TOTAL COMMUNICATIONS				\$ 2,802,000	
				\$ 55,025,500	

Three-Lane Reversible EJMT Alternatives

Alt02: Three Reversible Lanes

Lanes	3 @ 12'
Shoulders	2 @ 10'
Vertical Clearance	18.5'
Tunnel Radius	34'
Face Area, ft2	1900
Length, ft	8700
CPs	13

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
SCADA	FACP	Each	\$ 100,000	2	\$ 200,000	Duplicate FACP for Alternate control point
	Manual fire alarms	Each	\$ 5,000	32	\$ 160,000	Spaced at 275 ft
	LHD cabling and controls	LF	\$ 100	8,700	\$ 870,000	
	Signal wire cable	LF	\$ 50	17,400	\$ 870,000	Allowance for return loop
	Traffic monitoring CCTV	Each	\$ 5,000	128	\$ 640,000	Cameras at 140' OC, two cameras per location
	VIDS software	LS	\$ 100,000	1	\$ 100,000	
	VID servers	Each	\$ 20,000	43	\$ 860,000	Allow 3 CCTV cameras per VID server
	Traffic signals	Each	\$ 200,000	2	\$ 400,000	Signals at east and west portals
	Tunnel LED DMS	Each	\$ 270,000	17	\$ 4,590,000	Increase unit price to allow for two-sided, two-line, 24' wide DMS
	Operating systems software	LS	\$ 600,000	1	\$ 600,000	Added cost for increased complexity of operation
	OS Servers	Each	\$ 20,000	15	\$ 300,000	
	Air quality monitoring equipment (CO and NO)	Each	\$ 50,000	15	\$ 750,000	Sensors at 600' OC
	Access control and intrusion detection	Points	\$ 10,000	26	\$ 260,000	CP doors
	Control room console and video wall	LS	\$ 250,000	1	\$ 250,000	Allowance for large video wall
	Operator workstations	Each	\$ 10,000	4	\$ 40,000	
	OS Servers	Each	\$ 10,000	6	\$ 60,000	
	Racks, cabinets, conduit, conductors	Each	\$ 20,000	23	\$ 460,000	Added racks in CPs
	SCADA Software	LS	\$ 200,000	2	\$ 400,000	Allow for ~2x number of points
	Acceptance Testing/Commissioning	LS	\$ 400,000	2	\$ 800,000	Allow for ~2x number of points
	TOTAL SCADA					\$ 12,610,000
Ventilation	Tunnel ventilation fans	CFM	\$ 4	2,788,000	\$ 11,152,000	Add 1.5 x to account for elevation, 90% efficiency for reversed fans
	Conduits and conductors	LF	\$ 100	8,700	\$ 870,000	
TOTAL VENTILATION					\$ 12,022,000	
Cross Passages	Smoke control ventilation system	LS	\$ 100,000	13	\$ 1,300,000	Based on CP count
	Lighting	LS	\$ 10,000	13	\$ 130,000	
	Conduits and conductors	LS	\$ 20,000	13	\$ 260,000	

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
TOTAL CROSS PASSAGES					\$ 1,690,000	
Fixed Fire Suppression	Water supply, tanks	Each	\$ 100,000	1	\$ 100,000	
	Pressurization pumps	Each	\$ 10,000	2	\$ 20,000	
	Recirculation pump and boiler	Each	\$ 100,000	1	\$ 100,000	
	Wet standpipe, sprinklers, controls	LF	\$ 1,000	8,700	\$ 8,700,000	
	Pump control panel	LS	\$ 10,000	1	\$ 10,000	
	Isolation valves	Each	\$ 1,000	44	\$ 43,500	
	Cabinets	Each	\$ 10,000	2	\$ 20,000	
TOTAL FIRE SUPPRESSION					\$ 8,993,500	
Standpipe	Water supply, tanks	Each	\$ 100,000		\$ -	
	Pressurization pumps	Each	\$ 100,000	2	\$ 200,000	
	Recirculation pump and boiler	Each	\$ 100,000	2	\$ 200,000	Recirculation pump and heat at both portals
	Wet standpipe	LF	\$ 300	8,700	\$ 2,610,000	
	Jockey pump	Each	\$ 50,000	-	\$ -	Not required due to elevation of water source
	Pump control panel	Each	\$ 30,000	2	\$ 60,000	Allowance for 2 pump rooms
	Fire Hose Valves	Each	\$ 2,000	32	\$ 64,000	Spaced at 275' OC
	Isolation valves	Each	\$ 2,000	64	\$ 128,000	2 per fire hose valve
	Cabinets	Each	\$ 10,000	32	\$ 320,000	Cabinets at FHV
TOTAL STANDPIPE					\$ 3,582,000	
Lighting	Light fixtures	LF	\$ 400	8,700	\$ 3,480,000	
	Conduits and conductors	LF	\$ 100	8,700	\$ 870,000	
	Photocell controllers	Each	\$ 2,000	4	\$ 8,000	
TOTAL LIGHTING					\$ 4,358,000	
Power	Switchgear	Each	\$ 500,000	6	\$ 3,000,000	Increase unit price to account for increased connected load
	Generator	Each	\$ 200,000	2	\$ 400,000	Emergency loads only
	Ventilation MCCs	Each	\$ 30,000	48	\$ 1,440,000	
	Transformers	Each	\$ 200,000	20	\$ 4,000,000	Add transformers (13 kV/4160 V) at 7 CPs for vent fan motor power
	Conduit/raceways, conductors	LF	\$ 500	8,700	\$ 4,350,000	Added cost for 13 kV circuits through tunnel)
TOTAL POWER					\$ 13,190,000	
Communications	Fiber optic outside plant (conduit and fiber cable)	LF	\$ 100	8,700	\$ 870,000	Include loop through Bore 2
	Splice vaults	Each	\$ 20,000	20	\$ 400,000	Allow 1 splice vault per CP
	Switches, patch panels	Each	\$ 20,000	24	\$ 480,000	
	Cabinets	Each	\$ 10,000	22	\$ 220,000	
	Emergency telephones	Each	\$ 2,000	32	\$ 64,000	
	Emergency frequency radio rebroadcast	LS	\$ 768,000	1	\$ 768,000	
	Data links to control center	LF	\$ 10		\$ -	
TOTAL COMMUNICATIONS					\$ 2,802,000	
					\$ 59,247,500	

Three Lane EJMT Alternatives	
Alt03 Opt01: 3 lanes	
Alt03 Opt02: 3 lanes	
Lanes	3 @ 12'
Shoulders	2 @ 12'
Vertical Clearance	18.5'
Tunnel Radius	34'
Face Area, ft2	1964
Length, ft	8700
CPs	13

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
SCADA	FACP	Each	\$ 100,000	2	\$ 200,000	Duplicate FACP for Alternate control point
	Manual fire alarms	Each	\$ 5,000	32	\$ 160,000	Spaced at 275 ft
	LHD cabling and controls	LF	\$ 100	8,700	\$ 870,000	
	Signal wire cable	LF	\$ 50	17,400	\$ 870,000	Allowance for return loop
	Traffic monitoring CCTV	Each	\$ 5,000	128	\$ 640,000	Cameras at 140' OC, two cameras per location
	VIDS software	LS	\$ 100,000	1	\$ 100,000	
	VID servers	Each	\$ 20,000	43	\$ 860,000	Allow 3 CCTV cameras per VID server
	Traffic signals	Each	\$ 200,000	2	\$ 400,000	Signals at east and west portals
	Tunnel LED DMS	Each	\$ 180,000	17	\$ 3,060,000	Increase unit price to allow for two-line, 36' wide DMS
	Operating systems software	LS	\$ 600,000	1	\$ 600,000	Added cost for increased complexity of operation
	OS Servers	Each	\$ 20,000	15	\$ 300,000	
	Air quality monitoring equipment (CO and NO)	Each	\$ 50,000	15	\$ 750,000	Sensors at 600' OC
	Access control and intrusion detection	Points	\$ 10,000	26	\$ 260,000	CP doors
	Control room console and video wall	LS	\$ 250,000	1	\$ 250,000	Allowance for large video wall
	Operator workstations	Each	\$ 10,000	4	\$ 40,000	
	OS Servers	Each	\$ 10,000	6	\$ 60,000	
	Racks, cabinets, conduit, conductors	Each	\$ 20,000	23	\$ 460,000	Added racks in CPs
	SCADA Software	LS	\$ 200,000	2	\$ 400,000	Allow for ~2x number of points
Acceptance Testing/Commissioning	LS	\$ 400,000	2	\$ 800,000	Allow for ~2x number of points	
TOTAL SCADA					\$ 11,080,000	
Ventilation	Tunnel ventilation fans	CFM	\$ 4	2,882,000	\$ 11,528,000	Add 1.5 x to account for elevation, 90% efficiency for reversed fans
	Conduits and conductors	LF	\$ 100	8,700	\$ 870,000	
TOTAL VENTILATION					\$ 12,398,000	
Cross Passages	Smoke control ventilation system	LS	\$ 100,000	13	\$ 1,300,000	
	Lighting	LS	\$ 10,000	13	\$ 130,000	
	Conduits and conductors	LS	\$ 20,000	13	\$ 260,000	

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
TOTAL CROSS PASSAGES					\$ 1,690,000	
Fixed Fire Suppression	Water supply, tanks	Each	\$ 100,000	1	\$ 100,000	
	Pressurization pumps	Each	\$ 10,000	2	\$ 20,000	
	Recirculation pump and boiler	Each	\$ 100,000	1	\$ 100,000	
	Wet standpipe, sprinklers, controls	LF	\$ 1,000	8,700	\$ 8,700,000	
	Pump control panel	LS	\$ 10,000	1	\$ 10,000	
	Isolation valves	Each	\$ 1,000	44	\$ 43,500	
	Cabinets	Each	\$ 10,000	2	\$ 20,000	
TOTAL FIRE SUPPRESSION					\$ 8,993,500	
Standpipe	Water supply, tanks	Each	\$ 100,000		\$ -	
	Pressurization pumps	Each	\$ 100,000	2	\$ 200,000	
	Recirculation pump and boiler	Each	\$ 100,000	2	\$ 200,000	Recirculation pump and heat at both portals
	Wet standpipe	LF	\$ 300	8,700	\$ 2,610,000	
	Jockey pump	Each	\$ 50,000	-	\$ -	Not required due to elevation of water source
	Pump control panel	Each	\$ 30,000	2	\$ 60,000	Allowance for 2 pump rooms
	Fire Hose Valves	Each	\$ 2,000	32	\$ 64,000	Spaced at 275' OC
	Isolation valves	Each	\$ 2,000	64	\$ 128,000	2 per fire hose valve
	Cabinets	Each	\$ 10,000	32	\$ 320,000	Cabinets at FHV
TOTAL STANDPIPE					\$ 3,582,000	
Lighting	Light fixtures	LF	\$ 400	8,700	\$ 3,480,000	
	Conduits and conductors	LF	\$ 100	8,700	\$ 870,000	
	Photocell controllers	Each	\$ 2,000	4	\$ 8,000	
TOTAL LIGHTING					\$ 4,358,000	
Power	Switchgear	Each	\$ 500,000	6	\$ 3,000,000	Increase unit price to account for increased connected load
	Generator	Each	\$ 200,000	2	\$ 400,000	Emergency loads only
	Ventilation MCCs	Each	\$ 30,000	48	\$ 1,440,000	
	Transformers	Each	\$ 200,000	20	\$ 4,000,000	Add transformers (13 kV/4160 V) at 7 CPs for vent fan motor power
	Conduit/raceways, conductors	LF	\$ 500	8,700	\$ 4,350,000	Added cost for 13 kV circuits through tunnel)
TOTAL POWER					\$ 13,190,000	
Communications	Fiber optic outside plant (conduit and fiber cable)	LF	\$ 100	8,700	\$ 870,000	Include loop through Bore 2
	Splice vaults	Each	\$ 20,000	20	\$ 400,000	Allow 1 splice vault per CP
	Switches, patch panels	Each	\$ 20,000	24	\$ 480,000	
	Cabinets	Each	\$ 10,000	22	\$ 220,000	
	Emergency telephones	Each	\$ 2,000	32	\$ 64,000	
	Emergency frequency radio rebroadcast	LS	\$ 768,000	1	\$ 768,000	
Data links to control center	LF	\$ 10		\$ -		
TOTAL COMMUNICATIONS					\$ 2,802,000	
					\$ 58,093,500	

Caldecott Bore 4				Three Lane EJMT Alternatives			
		Alt04 Opt01: 3 lanes				Alt04 Opt02: 3 lanes	
Lanes	2 @ 12'	Lanes	3 @ 12'				
Shoulders	10', 2'	Shoulders	2 @ 12'				
Vertical Clearanc	16.7'	Vertical Clearance	18.5'				
Tunnel Radius	23.7'	Tunnel Radius	34'				
Face Area, ft2	1076	Face Area, ft2	1964				
Length, ft	3398	Length, ft	8700				
CPs	7	CPs	13				

Project Category	Scope Element	Units	Bid Average Unit Price	Quantity	Estimate	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
SCADA	FACP	Each	\$ 50,000	1	\$ 50,000	\$ 100,000	2	\$ 200,000	Duplicate FACP for Alternate control point
	Manual fire alarms	Each	\$ 5,000	17	\$ 85,000	\$ 5,000	32	\$ 160,000	Spaced at 275 ft
	LHD cabling and controls	LF	\$ 100	3,398	\$ 339,800	\$ 100	8,700	\$ 870,000	
	Signal wire cable	LF	\$ 50	6,796	\$ 339,800	\$ 50	17,400	\$ 870,000	Allowance for return loop
	Traffic monitoring CCTV	Each	\$ 2,000	25	\$ 50,000	\$ 5,000	128	\$ 640,000	Cameras at 140' OC, two cameras per location
	VIDS software	LS	\$ 100,000	1	\$ 100,000	\$ 100,000	1	\$ 100,000	
	VID servers	Each	\$ 20,000	9	\$ 180,000	\$ 20,000	43	\$ 860,000	Allow 3 CCTV cameras per VID server
	Traffic signals	Each	\$ 200,000	2	\$ 400,000	\$ 200,000	2	\$ 400,000	Signals at east and west portals
	Tunnel LED DMS	Each	\$ 90,000	14	\$ 1,260,000	\$ 180,000	17	\$ 3,060,000	Increase unit price to allow for two-line, 36' wide DMS
	Operating systems software	LS	\$ 300,000	1	\$ 300,000	\$ 600,000	1	\$ 600,000	Added cost for increased complexity of operation
	OS Servers	Each	\$ 20,000	8	\$ 160,000	\$ 20,000	15	\$ 300,000	
	Air quality monitoring equipment (CO and NO)	Each	\$ 50,000	5	\$ 250,000	\$ 50,000	15	\$ 750,000	Sensors at 600' OC
	Access control and intrusion detection	Points	\$ 10,000	17	\$ 170,000	\$ 10,000	26	\$ 260,000	CP doors
	Control room console and video wall	LS	\$ 100,000	1	\$ 100,000	\$ 250,000	1	\$ 250,000	Allowance for large video wall
	Operator workstations	Each	\$ 10,000	4	\$ 40,000	\$ 10,000	4	\$ 40,000	
	OS Servers	Each	\$ 10,000	4	\$ 40,000	\$ 10,000	6	\$ 60,000	
	Racks, cabinets, conduit, conductors	Each	\$ 20,000	10	\$ 200,000	\$ 20,000	23	\$ 460,000	Added racks in CPs
	SCADA Software	LS	\$ 200,000	1	\$ 200,000	\$ 200,000	2	\$ 400,000	Allow for ~2x number of points
Acceptance Testing/Commissioning	LS	\$ 400,000	1	\$ 400,000	\$ 400,000	2	\$ 800,000	Allow for ~2x number of points	
TOTAL SCADA					\$ 4,664,600				\$ 11,080,000
Ventilation	Tunnel ventilation fans	CFM	\$ 4	1,000,000	\$ 4,000,000	\$ 4	2,882,000	\$ 11,528,000	Add 1.5 x to account for elevation, 90% efficiency for reversed fans
	Conduits and conductors	LF	\$ 100	3,398	\$ 339,800	\$ 100	8,700	\$ 870,000	
TOTAL VENTILATION					\$ 4,339,800				\$ 12,398,000
Cross Passages	Smoke control ventilation system	LS	\$ 100,000	7	\$ 700,000	\$ 100,000	13	\$ 1,300,000	
	Lighting	LS	\$ 10,000	7	\$ 70,000	\$ 10,000	13	\$ 130,000	
	Conduits and conductors	LS	\$ 20,000	7	\$ 140,000	\$ 20,000	13	\$ 260,000	

Project Category	Scope Element	Units	Bid Average Unit Price	Quantity	Estimate	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
TOTAL CROSS PASSAGES					\$ 910,000			\$ 1,690,000	
Fixed Fire Suppression	Water supply, tanks	Each	\$ 100,000		\$ -	\$ 100,000	1	\$ 100,000	
	Pressurization pumps	Each	\$ 10,000		\$ -	\$ 10,000	2	\$ 20,000	
	Recirculation pump and boiler	Each	\$ 100,000		\$ -	\$ 100,000	1	\$ 100,000	
	Wet standpipe, sprinklers, controls	LF	\$ 1,000		\$ -	\$ 1,000	8,700	\$ 8,700,000	
	Pump control panel	LS	\$ 10,000		\$ -	\$ 10,000	1	\$ 10,000	
	Isolation valves	Each	\$ 1,000		\$ -	\$ 1,000	44	\$ 43,500	
	Cabinets	Each	\$ 10,000		\$ -	\$ 10,000	2	\$ 20,000	
TOTAL FIRE SUPPRESSION					\$ -			\$ 8,993,500	
Standpipe	Water supply, tanks	Each	\$ 100,000		\$ -	\$ 100,000		\$ -	
	Pressurization pumps	Each	\$ 100,000	2	\$ 200,000	\$ 100,000	2	\$ 200,000	
	Recirculation pump and boiler	Each	\$ 100,000		\$ -	\$ 100,000	2	\$ 200,000	Recirculation pump and heat at both portals
	Wet standpipe	LF	\$ 300	3,398	\$ 1,019,400	\$ 300	8,700	\$ 2,610,000	
	Jockey pump	Each	\$ 50,000	1	\$ 50,000	\$ 50,000	-	\$ -	Not required due to elevation of water source
	Pump control panel	Each	\$ 30,000	1	\$ 30,000	\$ 30,000	2	\$ 60,000	Allowance for 2 pump rooms
	Fire Hose Valves	Each	\$ 2,000	24	\$ 48,000	\$ 2,000	32	\$ 64,000	Spaced at 275' OC
	Isolation valves	Each	\$ 2,000	48	\$ 96,000	\$ 2,000	64	\$ 128,000	2 per fire hose valve
	Cabinets	Each	\$ 10,000	24	\$ 240,000	\$ 10,000	32	\$ 320,000	Cabinets at FHV
TOTAL STANDPIPE					\$ 1,683,400			\$ 3,582,000	
Lighting	Light fixtures	LF	\$ 400	3,398	\$ 1,359,200	\$ 400	8,700	\$ 3,480,000	
	Conduits and conductors	LF	\$ 50	3,398	\$ 169,900	\$ 100	8,700	\$ 870,000	
	Photocell controllers	Each	\$ 2,000	4	\$ 8,000	\$ 2,000	4	\$ 8,000	
TOTAL LIGHTING					\$ 1,537,100			\$ 4,358,000	
Power	Switchgear	Each	\$ 200,000	6	\$ 1,200,000	\$ 500,000	6	\$ 3,000,000	Increase unit price to account for increased connected load
	Generator	Each	\$ 200,000	2	\$ 400,000	\$ 200,000	2	\$ 400,000	Emergency loads only
	Ventilation MCCs	Each	\$ 30,000	19	\$ 570,000	\$ 30,000	48	\$ 1,440,000	
	Transformers	Each	\$ 200,000	8	\$ 1,600,000	\$ 200,000	20	\$ 4,000,000	Add transformers (13 kV/4160 V) at 7 CPs for vent fan motor power
	Conduit/raceways, conductors	LF	\$ 300	3,398	\$ 1,019,400	\$ 500	8,700	\$ 4,350,000	Added cost for 13 kV circuits through tunnel)
TOTAL POWER					\$ 4,789,400			\$ 13,190,000	
Communications	Fiber optic outside plant (conduit and fiber cable)	LF	\$ 100	3,398	\$ 339,800	\$ 100	8,700	\$ 870,000	Include loop through Bore 2
	Splice vaults	Each	\$ 20,000	8	\$ 160,000	\$ 20,000	20	\$ 400,000	Allow 1 splice vault per CP
	Switches, patch panels	Each	\$ 20,000	12	\$ 240,000	\$ 20,000	24	\$ 480,000	
	Cabinets	Each	\$ 10,000	10	\$ 100,000	\$ 10,000	22	\$ 220,000	
	Emergency telephones	Each	\$ 2,000	17	\$ 34,000	\$ 2,000	32	\$ 64,000	
	Emergency frequency radio rebroadcast	LS	\$ 300,000	1	\$ 300,000	\$ 768,000	1	\$ 768,000	
	Data links to control center	LF	\$ 10	-	\$ -	\$ 10		\$ -	
TOTAL COMMUNICATIONS					\$ 1,173,800			\$ 2,802,000	
					\$ 19,098,100			\$ 58,093,500	

Caldecott Bore 4				Two Lane, 2-Way Traffic EJMT Alternative			
		Alt05: 2 lanes, 2-way traffic					
		Alt04 Opt02: 3 lanes					
	Lanes	2 @ 12'		Lanes	2 @ 15'		
	Shoulders	10', 2'		Shoulders	2 @ 6'; 2 @ 4'		
	Vertical Clearanc	16.7'		Vertical Clearance	18.5'		
	Tunnel Radius	23.7'		Tunnel Radius	34'		
	Face Area, ft2	1076					
	Length, ft	3398		Length, ft	8700		
	CPs	7		CPs	13		Assume refuges constructed on north side, cross passages on south side

Project Category	Scope Element	Units	Bid Average Unit Price	Quantity	Estimate	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
SCADA	FACP	Each	\$ 50,000	1	\$ 50,000	\$ 100,000	2	\$ 200,000	Duplicate FACP for Alternate control point
	Manual fire alarms	Each	\$ 5,000	17	\$ 85,000	\$ 5,000	32	\$ 160,000	Spaced at 275 ft
	LHD cabling and controls	LF	\$ 100	3,398	\$ 339,800	\$ 100	8,700	\$ 870,000	
	Signal wire cable	LF	\$ 50	6,796	\$ 339,800	\$ 50	17,400	\$ 870,000	Allowance for return loop
	Traffic monitoring CCTV	Each	\$ 2,000	25	\$ 50,000	\$ 5,000	128	\$ 640,000	Cameras at 140' OC, two cameras per location
	VIDS software	LS	\$ 100,000	1	\$ 100,000	\$ 100,000	1	\$ 100,000	
	VID servers	Each	\$ 20,000	9	\$ 180,000	\$ 20,000	43	\$ 860,000	Allow 3 CCTV cameras per VID server
	Traffic signals	Each	\$ 200,000	2	\$ 400,000	\$ 200,000	2	\$ 400,000	Signals at east and west portals
	Tunnel LED DMS	Each	\$ 90,000	14	\$ 1,260,000	\$ 180,000	17	\$ 3,060,000	Increase unit price to allow for two-sided, one-line, 24' wide DMS
	Operating systems software	LS	\$ 300,000	1	\$ 300,000	\$ 600,000	1	\$ 600,000	Added cost for increased complexity of operation
	OS Servers	Each	\$ 20,000	8	\$ 160,000	\$ 20,000	15	\$ 300,000	
	Air quality monitoring equipment (CO and NO)	Each	\$ 50,000	5	\$ 250,000	\$ 50,000	15	\$ 750,000	Sensors at 600' OC
	Access control and intrusion detection	Points	\$ 10,000	17	\$ 170,000	\$ 10,000	26	\$ 260,000	CP doors
	Control room console and video wall	LS	\$ 100,000	1	\$ 100,000	\$ 250,000	1	\$ 250,000	Allowance for large video wall
	Operator workstations	Each	\$ 10,000	4	\$ 40,000	\$ 10,000	4	\$ 40,000	
	OS Servers	Each	\$ 10,000	4	\$ 40,000	\$ 10,000	6	\$ 60,000	
	Racks, cabinets, conduit, conductors	Each	\$ 20,000	10	\$ 200,000	\$ 20,000	23	\$ 460,000	Added racks in CPs
SCADA Software	LS	\$ 200,000	1	\$ 200,000	\$ 200,000	2	\$ 400,000	Allow for ~2x number of points	
Acceptance Testing/Commissioning	LS	\$ 400,000	1	\$ 400,000	\$ 400,000	2	\$ 800,000	Allow for ~2x number of points	
TOTAL SCADA				\$ 4,664,600				\$ 11,080,000	
Ventilation	Tunnel ventilation fans	CFM	\$ 4	1,000,000	\$ 4,000,000	\$ 560,000	8	\$ 4,480,000	See notes below; 140,000 cfm per fan @ \$4/cfm
	Conduits and conductors	LF	\$ 100	3,398	\$ 339,800	\$ 100	8,700	\$ 870,000	
	Motorized dampers	Each				\$ 60,000	79	\$ 4,740,000	Spacing 110' o.c.
	Duct platework	Each				\$ 100,000	8	\$ 800,000	Allowance
	Tunnel Ceiling Structure	LF				\$ 1,100	8,700	\$ 9,570,000	
TOTAL VENTILATION				\$ 4,339,800				\$ 20,460,000	
Cross Passages	Smoke control ventilation system	LS	\$ 100,000	7	\$ 700,000	\$ 100,000	13	\$ 1,300,000	
	Lighting	LS	\$ 10,000	7	\$ 70,000	\$ 10,000	13	\$ 130,000	
	Conduits and conductors	LS	\$ 20,000	7	\$ 140,000	\$ 20,000	13	\$ 260,000	

TOTAL CROSS PASSAGES

Fixed Fire Suppression	Water supply, tanks	Each	\$ 100,000	\$ -	\$ 100,000	1	\$ 100,000		
	Pressurization pumps	Each	\$ 10,000	\$ -	\$ 10,000	2	\$ 20,000		
	Recirculation pump and boiler	Each	\$ 100,000	\$ -	\$ 100,000	1	\$ 100,000		
	Wet standpipe, sprinklers, controls	LF	\$ 1,000	\$ -	\$ 1,000	8,700	\$ 8,700,000		
	Pump control panel	LS	\$ 10,000	\$ -	\$ 10,000	1	\$ 10,000		
	Isolation valves	Each	\$ 1,000	\$ -	\$ 1,000	44	\$ 43,500		
	Cabinets	Each	\$ 10,000	\$ -	\$ 10,000	2	\$ 20,000		
TOTAL FIRE SUPPRESSION				\$ -			\$ 8,993,500		
Standpipe	Water supply, tanks	Each	\$ 100,000	\$ -	\$ 100,000		\$ -		
	Pressurization pumps	Each	\$ 100,000	2	\$ 200,000	2	\$ 200,000		
	Recirculation pump and boiler	Each	\$ 100,000	\$ -	\$ 100,000	2	\$ 200,000	Recirculation pump and heat at both portals	
	Wet standpipe	LF	\$ 300	3,398	\$ 1,019,400	300	\$ 2,610,000		
	Jockey pump	Each	\$ 50,000	1	\$ 50,000		\$ -	Not required due to elevation of water source	
	Pump control panel	Each	\$ 30,000	1	\$ 30,000	2	\$ 60,000	Allowance for 2 pump rooms	
	Fire Hose Valves	Each	\$ 2,000	24	\$ 48,000	32	\$ 64,000	Spaced at 275' OC	
	Isolation valves	Each	\$ 2,000	48	\$ 96,000	64	\$ 128,000	2 per fire hose valve	
	Cabinets	Each	\$ 10,000	24	\$ 240,000	32	\$ 320,000	Cabinets at FHV	
TOTAL STANDPIPE				\$ 1,683,400			\$ 3,582,000		
Lighting	Light fixtures	LF	\$ 400	3,398	\$ 1,359,200	400	\$ 3,480,000		
	Conduits and conductors	LF	\$ 50	3,398	\$ 169,900	100	\$ 870,000		
	Photocell controllers	Each	\$ 2,000	4	\$ 8,000	4	\$ 8,000		
TOTAL LIGHTING				\$ 1,537,100			\$ 4,358,000		
Power	Switchgear	Each	\$ 200,000	6	\$ 1,200,000	500,000	6	\$ 3,000,000	Increase unit price to account for increased connected load
	Generator	Each	\$ 200,000	2	\$ 400,000	200,000	2	\$ 400,000	Emergency loads only
	Ventilation MCCs	Each	\$ 30,000	19	\$ 570,000	30,000	48	\$ 1,440,000	
	Transformers	Each	\$ 200,000	8	\$ 1,600,000	200,000	20	\$ 4,000,000	Add transformers (13 kV/4160 V) at 7 CPs for vent fan motor power
	Conduit/raceways, conductors	LF	\$ 300	3,398	\$ 1,019,400	500	8,700	\$ 4,350,000	Added cost for 13 kV circuits through tunnel)
TOTAL POWER				\$ 4,789,400			\$ 13,190,000		
Communications	Fiber optic outside plant (conduit and fiber cable)	LF	\$ 100	3,398	\$ 339,800	100	8,700	\$ 870,000	Include loop through Bore 2
	Splice vaults	Each	\$ 20,000	8	\$ 160,000	20,000	20	\$ 400,000	Allow 1 splice vault per CP
	Switches, patch panels	Each	\$ 20,000	12	\$ 240,000	20,000	24	\$ 480,000	
	Cabinets	Each	\$ 10,000	10	\$ 100,000	10,000	22	\$ 220,000	
	Emergency telephones	Each	\$ 2,000	17	\$ 34,000	2,000	32	\$ 64,000	
	Emergency frequency radio rebroadcast	LS	\$ 300,000	1	\$ 300,000	768,000	1	\$ 768,000	
	Data links to control center	LF	\$ 10	-	\$ -	10	\$ -		
TOTAL COMMUNICATIONS				\$ 1,173,800			\$ 2,802,000		
				\$ 19,098,100			\$ 66,155,500		

		New Tunnels near Hidden Valley Alternatives								
		Alt03 Opt02: Four lane tunnel and three lane tunnel								
		Alt03 Opt04								
		Alt04 Opt02								
		Four Lane Bore				Three Lane Bore				
		Lanes	4 @ 12'			Lanes	3 @ 12'			
		Shoulders	2 @ 12'			Shoulders	2 @ 12'			
		Vertical Clearance	18.5'			Vertical Clearance	18.5'			
		Tunnel Radius	Large			Tunnel Radius	38'			
		Face Area, ft2	2613			Face Area, ft2	1950			
		Length, ft	1070			Length, ft	980			
		CPs	1			CPs	1			
Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
SCADA	FACP	Each	\$ 50,000	1	\$ 50,000	Main FACP	\$ 50,000	1	\$ 50,000	Duplicate FACP for Alternate control point
	Manual fire alarms	Each	\$ 5,000	4	\$ 20,000	Spaced at 275 ft	\$ 5,000	4	\$ 20,000	Spaced at 275 ft
	LHD cabling and controls	LF	\$ 100	1,070	\$ 107,000		\$ 100	980	\$ 98,000	
	Signal wire cable	LF	\$ 50	-	\$ -	Return loop through other bore	\$ 50	-	\$ -	Return loop through other bore
	Traffic monitoring CCTV	Each	\$ 5,000	18	\$ 90,000	Cameras at 140' OC, two cameras per location plus 2 portal cams	\$ 5,000	16	\$ 80,000	Cameras at 140' OC, two cameras per location
	VIDS software	LS	\$ 25,000	1	\$ 25,000	Add capacity to EJMT system	\$ 25,000	-	\$ -	Add capacity to EJMT system
	VID servers	Each	\$ 20,000	6	\$ 120,000	Allow 3 CCTV cameras per VID server	\$ 20,000	5	\$ 100,000	Allow 3 CCTV cameras per VID server
	Traffic signals	Each	\$ 100,000	1	\$ 100,000	Signals at entrance portal	\$ 100,000	1	\$ 100,000	Signals at entrance portal
	Tunnel LED DMS	Each	\$ 120,000	2	\$ 240,000	Increase unit price to allow for two-line, 24' wide DMS	\$ 120,000	2	\$ 240,000	Increase unit price to allow for two-line, 24' wide DMS
	Operating systems software	LS	\$ 100,000	1	\$ 100,000	Add-on to EJMT OS software	\$ 600,000	-	\$ -	
	OS Servers	Each	\$ 20,000	4	\$ 80,000		\$ 20,000	-	\$ -	
	Air quality monitoring equipment (CO and NO)	Each	\$ 50,000	2	\$ 100,000	Sensors at 600' OC	\$ 50,000	2	\$ 100,000	Sensors at 600' OC
	Access control and intrusion detection	Points	\$ 10,000	1	\$ 10,000	CP doors	\$ 10,000	1	\$ 10,000	CP doors
	Control room console and video wall	LS	\$ 100,000	1	\$ 100,000	Add-on to EJMT video wall	\$ 100,000	-	\$ -	Allowance for large video wall
	Operator workstations	Each	\$ 10,000	-	\$ -		\$ 10,000	-	\$ -	
	OS Servers	Each	\$ 10,000	2	\$ 20,000		\$ 10,000	-	\$ -	
	Racks, cabinets, conduit, conductors	Each	\$ 20,000	4	\$ 80,000		\$ 20,000	-	\$ -	Added racks in CPs
SCADA Software	LS	\$ 90,000	1	\$ 90,000	Add-on to EJMT SCADA system	\$ 90,000	-	\$ -	Allow for ~2x number of points	
Acceptance Testing/Commissioning	LS	\$ 200,000	1	\$ 200,000	Reduced scope	\$ 200,000	-	\$ -	Allow for ~2x number of points	
TOTAL SCADA					\$ 1,532,000				\$ 798,000	
Ventilation	Tunnel ventilation fans	Each	\$ 228,000	6	\$ 1,368,000	Include vent fans, in lieu of engineering analysis per NFPA 502	\$ 228,000	6	\$ 1,368,000	Include vent fans, in lieu of engineering analysis per NFPA 502
	Conduits and conductors	LF	\$ 100	-	\$ -	Included in Fan cost	\$ 100	-	\$ -	Included in Fan cost
TOTAL VENTILATION					\$ 1,368,000				\$ 1,368,000	
Cross Passages	Smoke control ventilation system	LS	\$ 100,000	1	\$ 100,000	Based on CP count	\$ 100,000	-	\$ -	Based on CP count
	Lighting	LS	\$ 10,000	1	\$ 10,000		\$ 10,000	-	\$ -	
	Conduits and conductors	LS	\$ 20,000	1	\$ 20,000		\$ 20,000	-	\$ -	
TOTAL CROSS PASSAGES					\$ 130,000				\$ -	
Fixed Fire Suppression	Water supply, tanks	Each	\$ 100,000	-	\$ -		\$ 100,000	-	\$ -	
	Pressurization pumps	Each	\$ 10,000	-	\$ -		\$ 10,000	-	\$ -	
	Recirculation pump and boiler	Each	\$ 100,000	-	\$ -		\$ 100,000	-	\$ -	
	Wet standpipe, sprinklers, controls	LF	\$ 1,000	-	\$ -		\$ 1,000	-	\$ -	
	Pump control panel	LS	\$ 10,000	-	\$ -		\$ 10,000	-	\$ -	
	Isolation valves	Each	\$ 1,000	-	\$ -		\$ 1,000	-	\$ -	
	Cabinets	Each	\$ 10,000	-	\$ -		\$ 10,000	-	\$ -	
TOTAL FIRE SUPPRESSION					\$ -				\$ -	
Standpipe	Water supply System	LS	\$ 500,000	1	\$ 500,000	Develop water supply from Black Hawk water plant	\$ 500,000	-	\$ -	Develop water supply from Black Hawk water plant
	Pressurization pumps	Each	\$ 100,000	2	\$ 200,000		\$ 100,000	-	\$ -	
	Recirculation pump and boiler	Each	\$ 100,000	-	\$ -	Assume dry standpipe	\$ 100,000	-	\$ -	
	Dry Standpipe	LF	\$ 300	1,070	\$ 321,000		\$ 300	980	\$ 294,000	
	Jockey pump	Each	\$ 50,000	-	\$ -	Not required due to dry standpipe system	\$ 50,000	-	\$ -	Not required due to dry standpipe system
	Pump control panel	Each	\$ 30,000	1	\$ 30,000	Allow single pump room	\$ 30,000	-	\$ -	Allow single pump room
	Fire Hose Valves	Each	\$ 2,000	4	\$ 8,000	Spaced at 275' OC	\$ 2,000	4	\$ 8,000	Spaced at 275' OC
	Isolation valves	Each	\$ 2,000	8	\$ 16,000	2 per fire hose valve	\$ 2,000	8	\$ 16,000	2 per fire hose valve
Cabinets	Each	\$ 10,000	4	\$ 40,000	Cabinets at FHV	\$ 10,000	4	\$ 40,000	Cabinets at FHV	

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
TOTAL STANDPIPE					\$ 1,115,000				\$ 358,000	
Lighting	Light fixtures	LF	\$ 400	1,070	\$ 428,000		\$ 400	980	\$ 392,000	
	Conduits and conductors	LF	\$ 100	1,070	\$ 107,000		\$ 100	980	\$ 98,000	
	Photocell controllers	Each	\$ 2,000	2	\$ 4,000		\$ 2,000	2	\$ 4,000	
TOTAL LIGHTING					\$ 539,000				\$ 494,000	
Power	Switchgear	Each	\$ 200,000	2	\$ 400,000		\$ 200,000	-	\$ -	
	Generator	Each	\$ 200,000	-	\$ -	Assume two feeder arrangement from commercial power	\$ 200,000	-	\$ -	Assume two feeder arrangement from commercial power
	Ventilation MCCs	Each	\$ 30,000	6	\$ 180,000		\$ 30,000	6	\$ 180,000	
	Transformers	Each	\$ 200,000	2	\$ 400,000	Service voltage to 480V and 204/120V	\$ 200,000	1	\$ 200,000	Service voltage to 480V and 204/120V
	Conduit/raceways, conductors	LF	\$ 300	1,070	\$ 321,000		\$ 300	980	\$ 294,000	
TOTAL POWER					\$ 1,301,000				\$ 674,000	
Communications	Fiber optic outside plant (conduit and fiber cable)	LF	\$ 100	1,070	\$ 107,000		\$ 100	980	\$ 98,000	
	Splice vaults	Each	\$ 20,000	3	\$ 60,000	Allow 1 splice vault per CP	\$ 20,000	3	\$ 60,000	Allow 1 splice vault per CP
	Switches, patch panels	Each	\$ 20,000	3	\$ 60,000		\$ 20,000	1	\$ 20,000	
	Cabinets	Each	\$ 10,000	3	\$ 30,000		\$ 10,000	1	\$ 10,000	
	Emergency telephones	Each	\$ 2,000	4	\$ 8,000		\$ 2,000	4	\$ 8,000	
	Emergency frequency radio rebroadcast	LS	\$ 94,000	1	\$ 94,000	Assume active signal through tunnel	\$ 94,000	-	\$ -	Assume active signal through tunnel
	Data links to control center	LF	\$ 10		\$ -	Tie Tunnels to EJMT Control Room via T1 lines.	\$ 10		\$ -	Tie Tunnels to EJMT Control Room via T1 lines.
TOTAL COMMUNICATIONS					\$ 359,000				\$ 196,000	
					\$ 6,344,000				\$ 3,888,000	

New Tunnel near SH 6 Alternatives

Alt03 Opt02: Four lane tunnel and three lane tunnel

Alt03 Opt04

Alt04 Opt02

Lanes	4 @ 12'
Shoulders	2 @ 12'
Vertical Clearance	18.5'
Tunnel Radius	Large
Face Area, ft2	2613
Length, ft	1650
CPs	1

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
SCADA	FACP	Each	\$ 50,000	1	\$ 50,000	Add single FACP with data link to EJMT Control Room; no Alternate control point
	Manual fire alarms	Each	\$ 5,000	6	\$ 30,000	Spaced at 275 ft
	LHD cabling and controls	LF	\$ 100	1,650	\$ 165,000	
	Signal wire cable	LF	\$ 50	3,300	\$ 165,000	Allowance for return loop
	Traffic monitoring CCTV	Each	\$ 5,000	14	\$ 70,000	Cameras at 140' OC, one camera per location, 2 portal cams
	VIDS software	LS	\$ 25,000	1	\$ 25,000	Add capacity to EJMT system
	VID servers	Each	\$ 20,000	5	\$ 100,000	Allow 3 CCTV cameras per VID server
	Traffic signals	Each	\$ 100,000	1	\$ 100,000	Signals at entrance portal
	Tunnel LED DMS	Each	\$ 120,000	3	\$ 360,000	Increase unit price to allow for two-line, 24' wide DMS
	Operating systems software	LS	\$ 100,000	1	\$ 100,000	Add-on to EJMT OS software
	OS Servers	Each	\$ 20,000	2	\$ 40,000	
	Air quality monitoring equipment (CO and NO)	Each	\$ 50,000	3	\$ 150,000	Sensors at 600' OC
	Access control and intrusion detection	Points	\$ 10,000	2	\$ 20,000	CP doors
	Control room console and video wall	LS	\$ 100,000	1	\$ 100,000	Add-on to EJMT video wall
	Operator workstations	Each	\$ 10,000	-	\$ -	
	OS Servers	Each	\$ 10,000	2	\$ 20,000	
	Racks, cabinets, conduit, conductors	Each	\$ 20,000	4	\$ 80,000	
	SCADA Software	LS	\$ 90,000	1	\$ 90,000	Add-on to EJMT SCADA system
	Acceptance Testing/Commissioning	LS	\$ 200,000	1	\$ 200,000	Reduced scope
	TOTAL SCADA					\$ 1,865,000
Ventilation	Tunnel ventilation fans	Each	\$ 228,000	8	\$ 1,824,000	Include vent fans, in lieu of engineering analysis per NFPA 502
	Conduits and conductors	LF	\$ 100	-	\$ -	Included in Fan cost
TOTAL VENTILATION					\$ 1,824,000	
Cross Passages	Smoke control ventilation system	LS	\$ 100,000	1	\$ 100,000	
	Lighting	LS	\$ 10,000	1	\$ 10,000	
	Conduits and conductors	LS	\$ 20,000	1	\$ 20,000	
TOTAL CROSS PASSAGES					\$ 130,000	
Fixed Fire Suppression	Water supply, tanks	Each	\$ 100,000	1	\$ 100,000	
	Pressurization pumps	Each	\$ 10,000	2	\$ 20,000	
	Recirculation pump and boiler	Each	\$ 100,000	1	\$ 100,000	
	Wet standpipe, sprinklers, controls	LF	\$ 1,000	1,650	\$ 1,650,000	
	Pump control panel	LS	\$ 10,000	1	\$ 10,000	
	Isolation valves	Each	\$ 1,000	8	\$ 8,250	
	Cabinets	Each	\$ 10,000	2	\$ 20,000	

TOTAL FIRE SUPPRESSION

Standpipe	Water supply, tanks	Each	\$ 100,000	1	\$ 100,000	Develop water supply from Black Hawk water plant
	Pressurization pumps	Each	\$ 100,000	2	\$ 200,000	
	Recirculation pump and boiler	Each	\$ 100,000	-	\$ -	Assume dry standpipe
	Dry standpipe	LF	\$ 300	-	\$ -	
	Jockey pump	Each	\$ 50,000	-	\$ -	Not required due to dry standpipe system
	Pump control panel	Each	\$ 30,000	1	\$ 30,000	Allow single pump room
	Fire Hose Valves	Each	\$ 2,000	0	\$ -	Spaced at 275' OC
	Isolation valves	Each	\$ 2,000	-	\$ -	2 per fire hose valve
	Cabinets	Each	\$ 10,000	-	\$ -	Cabinets at FHV

\$ 1,908,250**TOTAL STANDPIPE**

Lighting	Light fixtures	LF	\$ 400	1,650	\$ 660,000	
	Conduits and conductors	LF	\$ 100	1,650	\$ 165,000	
	Photocell controllers	Each	\$ 2,000	4	\$ 8,000	

\$ 330,000**TOTAL LIGHTING**

Power	Switchgear	Each	\$ 200,000	2	\$ 400,000	
	Generator	Each	\$ 200,000	-	\$ -	Assume two feeder arrangement from commercial power
	Ventilation MCCs	Each	\$ 30,000	6	\$ 180,000	
	Transformers	Each	\$ 200,000	2	\$ 400,000	Service voltage to 480V and 204/120V
	Conduit/raceways, conductors	LF	\$ 300	-	\$ -	

\$ 833,000**TOTAL POWER**

Communications	Fiber optic outside plant (conduit and fiber cable)	LF	\$ 100	3,300	\$ 330,000	Include loop on adjacent I-70 shoulder
	Splice vaults	Each	\$ 20,000	3	\$ 60,000	Allow 1 splice vault per CP
	Switches, patch panels	Each	\$ 20,000	3	\$ 60,000	
	Cabinets	Each	\$ 10,000	3	\$ 30,000	
	Emergency telephones	Each	\$ 2,000	6	\$ 12,000	
	Emergency frequency radio rebroadcast	LS	\$ 146,000	1	\$ 146,000	Assume active signal through tunnel
	Data links to control center	LF	\$ 10		\$ -	Tie Tunnels to EJMT Control Room via T1 lines.

\$ 980,000**TOTAL COMMUNICATIONS****\$ 638,000****\$ 8,508,250**

Two-Lane Reversible Twin Tunnel Alternative

Alt01: 2 Rversible Lanes

Lanes	2 @ 12'
Shoulders	2 @ 10'
Vertical Clearance	18.5'
Tunnel Radius	26'
Face Area, ft2	1374
Length, ft	1300
CPs	1

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
SCADA	FACP	Each	\$ 50,000	1	\$ 50,000	Add single FACP with data link to EJMT Control Room; no Alternate control
	Manual fire alarms	Each	\$ 5,000	5	\$ 25,000	Spaced at 275 ft
	LHD cabling and controls	LF	\$ 100	1,300	\$ 130,000	
	Signal wire cable	LF	\$ 50	2,600	\$ 130,000	Allowance for return loop
	Traffic monitoring CCTV	Each	\$ 5,000	11	\$ 55,000	Cameras at 140' OC, one camera per location, 2 portal cams
	VIDS software	LS	\$ 25,000	1	\$ 25,000	Add capacity to EJMT system
	VID servers	Each	\$ 20,000	4	\$ 80,000	Allow 3 CCTV cameras per VID server
	Traffic signals	Each	\$ 100,000	2	\$ 200,000	Signals at east and west portals
	Tunnel LED DMS	Each	\$ 120,000	3	\$ 360,000	Increase unit price to allow for two-sided, two-line, 24' wide DMS
	Operating systems software	LS	\$ 100,000	1	\$ 100,000	Add-on to EJMT OS software
	OS Servers	Each	\$ 20,000	2	\$ 40,000	
	Air quality monitoring equipment (CO and NO)	Each	\$ 50,000	2	\$ 100,000	Sensors at 600' OC
	Access control and intrusion detection	Points	\$ 10,000	2	\$ 20,000	CP doors
	Control room console and video wall	LS	\$ 100,000	1	\$ 100,000	Add-on to EJMT video wall
	Operator workstations	Each	\$ 10,000	-	\$ -	
	OS Servers	Each	\$ 10,000	2	\$ 20,000	
	Racks, cabinets, conduit, conductors	Each	\$ 20,000	4	\$ 80,000	
	SCADA Software	LS	\$ 90,000	1	\$ 90,000	Add-on to EJMT SCADA system
Acceptance Testing/Commissioning	LS	\$ 200,000	1	\$ 200,000	Reduced scope	
TOTAL SCADA					\$ 1,805,000	
Ventilation	Tunnel ventilation fans	Each	\$ 228,000	6	\$ 1,368,000	Include vent fans, in lieu of engineering analysis per NFPA 502
	Conduits and conductors	LF	\$ 100	-	\$ -	Included in Fan cost
TOTAL VENTILATION					\$ 1,368,000	
Cross Passages	Smoke control ventilation system	LS	\$ 100,000	1	\$ 100,000	Based on CP count
	Lighting	LS	\$ 10,000	1	\$ 10,000	
	Conduits and conductors	LS	\$ 20,000	1	\$ 20,000	

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
TOTAL CROSS PASSAGES					\$ 130,000	
Fixed Fire Suppression	Water supply, tanks	Each	\$ 100,000	-	\$ -	
	Pressurization pumps	Each	\$ 10,000	-	\$ -	
	Recirculation pump and boiler	Each	\$ 100,000	-	\$ -	
	Wet standpipe, sprinklers, controls	LF	\$ 1,000	-	\$ -	
	Pump control panel	LS	\$ 10,000	-	\$ -	
	Isolation valves	Each	\$ 1,000	-	\$ -	
	Cabinets	Each	\$ 10,000	-	\$ -	
TOTAL FIRE SUPPRESSION					\$ -	
Standpipe	Water supply, tanks	Each	\$ 100,000		\$ -	Share water supply with existing Twin Tunnels
	Pressurization pumps	Each	\$ 100,000	2	\$ 200,000	
	Recirculation pump and boiler	Each	\$ 100,000	-	\$ -	Assume dry standpipe
	Standpipe	LF	\$ 300	1,300	\$ 390,000	
	Jockey pump	Each	\$ 50,000	-	\$ -	Not required due to dry standpipe system
	Pump control panel	Each	\$ 30,000	1	\$ 30,000	Allow single pump room
	Fire Hose Valves	Each	\$ 2,000	5	\$ 10,000	Spaced at 275' OC
	Isolation valves	Each	\$ 2,000	10	\$ 20,000	2 per fire hose valve
	Cabinets	Each	\$ 10,000	5	\$ 50,000	Cabinets at FHV
	TOTAL STANDPIPE					\$ 700,000
Lighting	Light fixtures	LF	\$ 400	1,300	\$ 520,000	
	Conduits and conductors	LF	\$ 100	1,300	\$ 130,000	
	Photocell controllers	Each	\$ 2,000	4	\$ 8,000	
TOTAL LIGHTING					\$ 658,000	
Power	Switchgear	Each	\$ 200,000	2	\$ 400,000	
	Generator	Each	\$ 200,000	-	\$ -	Assume two feeder arrangement from commercial power
	Ventilation MCCs	Each	\$ 30,000	6	\$ 180,000	
	Transformers	Each	\$ 200,000	2	\$ 400,000	Service voltage to 480V and 204/120V
	Conduit/raceways, conductors	LF	\$ 300	1,300	\$ 390,000	
TOTAL POWER					\$ 1,370,000	
Communications	Fiber optic outside plant (conduit and fiber cable)	LF	\$ 100	2,600	\$ 260,000	Include loop through existing Twin Tunnel #2
	Splice vaults	Each	\$ 20,000	3	\$ 60,000	Allow 1 splice vault per CP
	Switches, patch panels	Each	\$ 20,000	8	\$ 160,000	
	Cabinets	Each	\$ 10,000	8	\$ 80,000	
	Emergency telephones	Each	\$ 2,000	5	\$ 10,000	
	Emergency frequency radio rebroadcast	LS	\$ 115,000	-	\$ -	Assume active signal through tunnel
	Data links to control center	LF	\$ 10	-	\$ -	Tie Twin Tunnels to EJMT Control Room via T1 lines.
TOTAL COMMUNICATIONS					\$ 570,000	
					\$ 6,601,000	

Three-Lane Reversible Twin Tunnel Alternative

Alt02: Three Reversible Lanes

Lanes	3 @ 12'
Shoulders	2 @ 10'
Vertical Clearance	18.5'
Tunnel Radius	34'
Face Area, ft2	1900
Length, ft	1650
CPs	1

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
SCADA	FACP	Each	\$ 50,000	1	\$ 50,000	Add single FACP with data link to EJMT Control Room; no Alternate control poi
	Manual fire alarms	Each	\$ 5,000	6	\$ 30,000	Spaced at 275 ft
	LHD cabling and controls	LF	\$ 100	1,650	\$ 165,000	
	Signal wire cable	LF	\$ 50	3,300	\$ 165,000	Allowance for return loop
	Traffic monitoring CCTV	Each	\$ 5,000	14	\$ 70,000	Cameras at 140' OC, one camera per location, 2 portal cams
	VIDS software	LS	\$ 25,000	1	\$ 25,000	Add capacity to EJMT system
	VID servers	Each	\$ 20,000	5	\$ 100,000	Allow 3 CCTV cameras per VID server
	Traffic signals	Each	\$ 100,000	2	\$ 200,000	Signals at east and west portals
	Tunnel LED DMS	Each	\$ 120,000	3	\$ 360,000	Increase unit price to allow for two-sided, two-line, 24' wide DMS
	Operating systems software	LS	\$ 100,000	1	\$ 100,000	Add-on to EJMT OS software
	OS Servers	Each	\$ 20,000	2	\$ 40,000	
	Air quality monitoring equipment (CO and NO)	Each	\$ 50,000	3	\$ 150,000	Sensors at 600' OC
	Access control and intrusion detection	Points	\$ 10,000	2	\$ 20,000	CP doors
	Control room console and video wall	LS	\$ 100,000	1	\$ 100,000	Add-on to EJMT video wall
	Operator workstations	Each	\$ 10,000	-	\$ -	
	OS Servers	Each	\$ 10,000	2	\$ 20,000	
	Racks, cabinets, conduit, conductors	Each	\$ 20,000	4	\$ 80,000	
	SCADA Software	LS	\$ 90,000	1	\$ 90,000	Add-on to EJMT SCADA system
Acceptance Testing/Commissioning	LS	\$ 200,000	1	\$ 200,000	Reduced scope	
TOTAL SCADA					\$ 1,965,000	
Ventilation	Tunnel ventilation fans	CFM	\$ 228,000	8	\$ 1,824,000	Include vent fans, in lieu of engineering analysis per NFPA 502
	Conduits and conductors	LF	\$ 100	-	\$ -	Included in Fan cost
TOTAL VENTILATION					\$ 1,824,000	
Cross Passages	Smoke control ventilation system	LS	\$ 100,000	1	\$ 100,000	Based on CP count
	Lighting	LS	\$ 10,000	1	\$ 10,000	
	Conduits and conductors	LS	\$ 20,000	1	\$ 20,000	

Project Category	Scope Element	Units	Unit Price	Quantity	Estimate	Basis of Estimated Unit Price, Quantity
TOTAL CROSS PASSAGES					\$ 130,000	
Fixed Fire Suppression	Water supply, tanks	Each	\$ 100,000	-	\$ -	
	Pressurization pumps	Each	\$ 10,000	-	\$ -	
	Recirculation pump and boiler	Each	\$ 100,000	-	\$ -	
	Wet standpipe, sprinklers, controls	LF	\$ 1,000	-	\$ -	
	Pump control panel	LS	\$ 10,000	-	\$ -	
	Isolation valves	Each	\$ 1,000	-	\$ -	
	Cabinets	Each	\$ 10,000	-	\$ -	
TOTAL FIRE SUPPRESSION					\$ -	
Standpipe	Water supply, tanks	Each	\$ 100,000		\$ -	Share water supply with existing Twin Tunnels
	Pressurization pumps	Each	\$ 100,000	2	\$ 200,000	
	Recirculation pump and boiler	Each	\$ 100,000	-	\$ -	Assume dry standpipe
	Wet standpipe	LF	\$ 300	1,650	\$ 495,000	
	Jockey pump	Each	\$ 50,000	-	\$ -	Not required due to dry standpipe system
	Pump control panel	Each	\$ 30,000	1	\$ 30,000	Allow single pump room
	Fire Hose Valves	Each	\$ 2,000	6	\$ 12,000	Spaced at 275' OC
	Isolation valves	Each	\$ 2,000	12	\$ 24,000	2 per fire hose valve
	Cabinets	Each	\$ 10,000	6	\$ 60,000	Cabinets at FHV
TOTAL STANDPIPE					\$ 821,000	
Lighting	Light fixtures	LF	\$ 400	1,650	\$ 660,000	
	Conduits and conductors	LF	\$ 100	1,650	\$ 165,000	
	Photocell controllers	Each	\$ 2,000	4	\$ 8,000	
TOTAL LIGHTING					\$ 833,000	
Power	Switchgear	Each	\$ 200,000	2	\$ 400,000	
	Generator	Each	\$ 200,000	-	\$ -	Assume two feeder arrangement from commercial power
	Ventilation MCCs	Each	\$ 30,000	8	\$ 240,000	
	Transformers	Each	\$ 200,000	2	\$ 400,000	Service voltage to 480V and 204/120V
	Conduit/raceways, conductors	LF	\$ 300	1,650	\$ 495,000	
TOTAL POWER					\$ 1,535,000	
Communications	Fiber optic outside plant (conduit and fiber cable)	LF	\$ 100	3,300	\$ 330,000	Include loop through existing Twin Tunnel #2
	Splice vaults	Each	\$ 20,000	3	\$ 60,000	Allow 1 splice vault per CP
	Switches, patch panels	Each	\$ 20,000	8	\$ 160,000	
	Cabinets	Each	\$ 10,000	8	\$ 80,000	
	Emergency telephones	Each	\$ 2,000	6	\$ 12,000	
	Emergency frequency radio rebroadcast	LS	\$ 146,000	-	\$ -	Assume active signal through tunnel
	Data links to control center	LF	\$ 10	-	\$ -	Tie Twin Tunnels to EJMT Control Room via T1 lines.
TOTAL COMMUNICATIONS					\$ 642,000	
					\$ 7,750,000	