



Estimate of annual operating costs

A. Management and operation of tunnel control building

1. Manager (Assume 1 individual in full time management position)

Manager 2080 hrs/yr @ 95 \$/hr= \$ 197600 /yr

2. Office assistants (assume 2 full time office assistants)

Office staff 4160 hrs/yr @ 55 \$/hr= \$ 228800 /yr

3. Cleaners (assume 2 full time cleaners 5 days per week)

Cleaners 4160 hrs/yr @ 45 \$/hr= \$ 187200 /yr

Sub-total A - \$ 613600 /yr

B. Traffic Supervision Costs

1. Closed circuit TV system cost= \$ 1062300
written-off over 40 years = \$ 26557.5 /yr

2. Monitoring staff (assume full time monitoring by 2 men 24 hours per day)

CCTV personnel 17472 hrs/yr @ 60 \$/hr= \$ 1048320 /yr

Sub-total B - \$ 1074878 /yr

C. Emergency Truck Costs

1. Assume 1 truck and each replaced every 15 years

Emergency truck costs= \$ 70000
written-off over 15 years = \$ 4666.667 /yr

2. Truck operators (assume 2 men for each truck 24 hours per day)

Truck operators 34944 hrs/yr @ 60 \$/hr= \$ 2096640 /yr

3. Truck maintenance and fuel

Allow \$ 20000 /yr

Sub-total C - \$ 2121307 /yr



Estimate of annual operating costs

D. Energy Costs

2.7 kilometre long twin bore Eisenhower Highway Tunnel on I70 in Colorado has annual electricity bill of \$840,000

Assume energy costs largely governed by tunnel length

For 20 km long tunnel

Lane factor= 0.25

Energy cost - \$ 777777.8

Sub-total D - \$ 777778 /yr

Total Operating Cost - \$ 4587562 /yr



Estimate of annual maintenance costs

A. Electrical Maintenance Costs

1. Labour (Assume equivalent of 1 electrician present at all times)

Electrician 1 8736 hrs/yr @ 65 \$/hr= \$ 567840 /yr

2. Materials/replacement of equipment (assume electrical equipment replaced once every 40 years)

Electrical equipment cost= \$ 7035000 (sub-station, generators, etc.)
written-off over 40 years = \$ 175875 /yr

Fire suppression equipment cost= \$ 4000000
written-off over 40 years = \$ 100000 /yr

Signalling equipment cost= \$ 0
written-off over 40 years = \$ 0 /yr

Gas detection equipment cost= \$ 900000
written-off over 40 years = \$ 22500 /yr

3. Platform truck for replacing lights etc.

Platform truck= \$ 60000
written-off over 15 years = \$ 4000.00 /yr

4. Platform truck maintenance and fuel

Allow \$ 5000 /yr

Sub-total A - \$ 875215 /yr

B. Mechanical Maintenance Costs

1. Labour (Assume equivalent of 1 mechanic/maintenance technician present at all times)

Mechanic 8736 hrs/yr @ 65 \$/hr= \$ 567840 /yr

2. Materials/replacement of equipment (assume mechanical equipment replaced every 40 years)

Ventilation equipment cost= \$ 6000000
written-off over 40 years = \$ 150000 /yr

3. Van for use by the mechanical/electrical maintenance staff (assume 1 no.)

Maintenance van= \$ 25000
written-off over 8 years = \$ 3125 /yr



Estimate of annual maintenance costs

B. Mechanical Maintenance Costs contd.

4. Van maintenance and fuel

Allow \$ 5000 /yr

Sub-total B - \$ 725965 /yr

C. Structure Maintenance Costs

1. Inspection (assume 3 man inspection crew for 5 weeks once every 4 years)

Senior engineer	50	hrs/yr @	130	\$/hr=	\$	6500	/yr
Engineer 1	50	hrs/yr @	80	\$/hr=	\$	4000	/yr
Engineer 2	50	hrs/yr @	80	\$/hr=	\$	4000	/yr

2. Tunnel cleaning and maintenance (assume 4 man crew on single shift basis throughout year)

Labourers 11648 hrs/yr @ 50 \$/hr= \$ 582400 /yr

3. Street cleaner vehicle

Street cleaner vehicle= \$ 65000
written-off over 15 years = \$ 4333.333 /yr

4. Street cleaner vehicle maintenance and fuel

Allow \$ 5000 /yr

5. Washer truck

Washing truck= \$ 40000
written-off over 15 years = \$ 2666.667 /yr

6. Washer truck maintenance and fuel

Allow \$ 5000 /yr

Sub-total C - \$ 613900 /yr

Total Maintenance Cost - \$ 2215080 /yr