



Group Exercise (Feb 10)

Roads or Runways



Pacific Region Infrastructure Facility



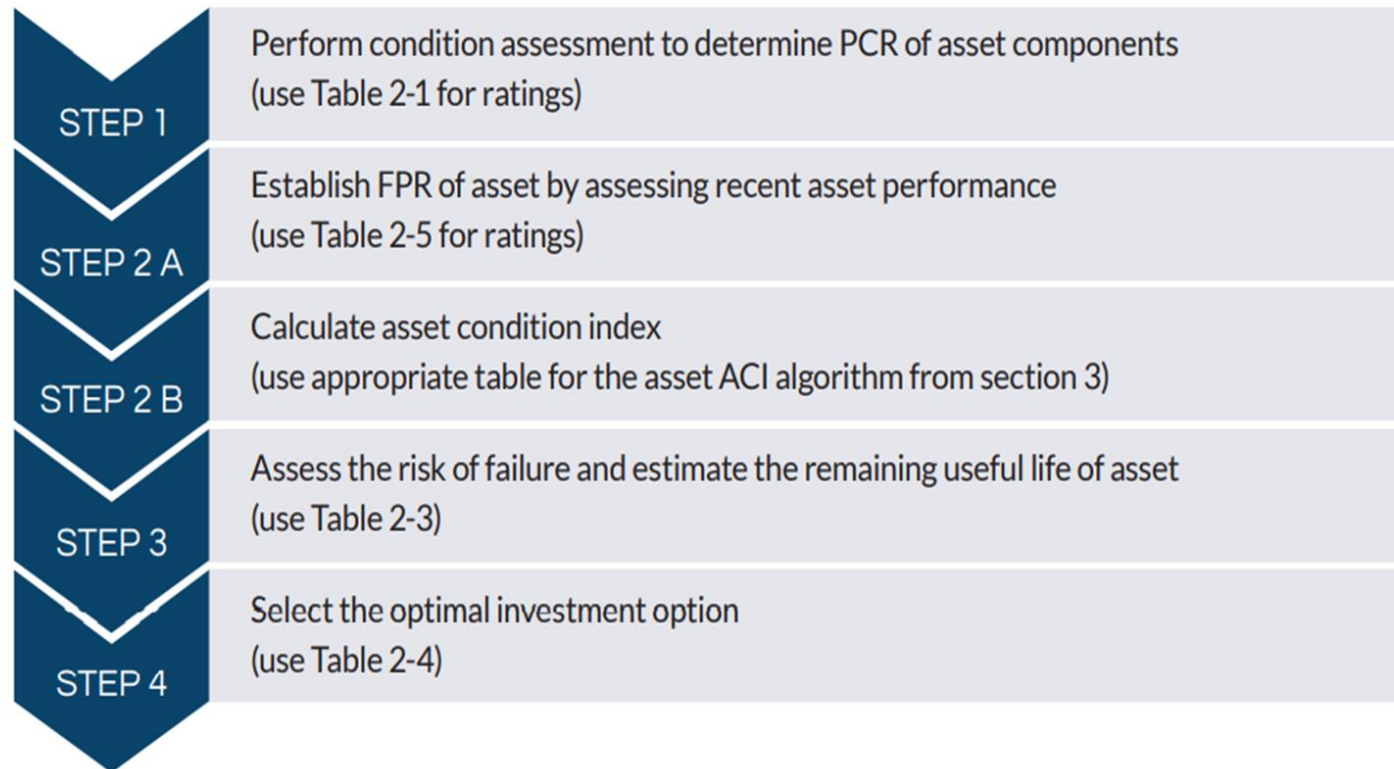
Asset Condition Assessment For Roads

- Condition Assessment of a 2 km long, 8 m wide, local road section, in Palau revealed the entire road section looks as shown in the photograph, with a large number of pot holes damaging the surface seal as well as the base course pavement.
- There have been numerous public complaints about this road section.
- Determine its condition index and formulate investment plan:



Asset Condition Assessment of Road

Because we have information about the physical condition and functional performance of the road, to calculate condition assessment index and develop investment plan for this road section we will use the second approach with the following steps (Section 2: Figure 2-2) :



Step 1

- Perform condition assessment to determine PCR of asset components (use Table 2-1 for ratings)

To assess the road condition, we will assign the most appropriate physical condition ratings from **Section 2: Table 2-1** to each of the road's main components:

Table 2-1 (Section 2)

Asset Component Condition	Physical Condition Rating	Interpretation
Asset Component in brand new condition, with no wear, no damage, no deformation, no defects, no deterioration, no impairment	5	Excellent
Asset Component in “like new” condition, with minor wear and no damage, no defects, no deformation, no deterioration and no impairment	4	Good
Asset Component shows minor wear, minor deformation, minor damage, minor defects, minor deterioration, minor impairment, asset condition can be maintained through normal preventative maintenance	3	Fair
Asset Component with major deformation, degradation, deterioration, damage or defects and serious impairment in condition; however component condition can be restored through economically efficient rehabilitation/refurbishment of degraded/faulty components.	2	Poor
Asset Component with major degradation, deterioration, damage or defects and serious impairment in condition, and it is not possible to restore the component condition through economically efficient rehabilitation/refurbishment	1	Very Poor



Step 1

- Perform condition assessment to determine PCR of asset components (use Table 2-1 for ratings)

3.2 Roads

Table 3-3: Sealed Road Assessed on Component Condition Only

Condition Criteria	Weight	Condition Ratings	Maximum Score	Actual Score
Asset component physical condition	Pavement base course	1,2,3,4,5	20	
	Surface seal	1,2,3,4,5	20	
	Curb and gutter	1,2,3,4,5	5	
	Drainage system	1,2,3,4,5	5	
Total score	10		50	
Asset condition index = (actual score/maximum score) x 100				

Table 3-4: Sealed Road Assessed on Component Condition and Asset Performance

Condition Criteria	Weight	Condition Ratings	Maximum Score	Actual Score
Component Physical Condition	Pavement base course	1,2,3,4,5	20	
	Surface seal	1,2,3,4,5	20	
	Curb and gutter	1,2,3,4,5	5	
	Drainage system	1,2,3,4,5	5	
Asset Functional Performance	4	1,2,3,4,5	20	
Total score	14		70	
Asset condition index = (actual score/maximum score) x 100				

Table 3-5: Unsealed Road or Footpath Assessed on Component Condition Only

Condition Criteria	Weight	Condition Ratings	Maximum Score	Actual Score
Asset component physical condition	Pavement	1,2,3,4,5	40	
Total score	8		40	
Asset condition index = (actual score/maximum score) x 100				

Table 3-6: Unsealed Road or Footpath Assessed on Component Condition and Asset Performance

Condition Criteria	Weight	Condition Ratings	Maximum Score	Actual Score
Component Physical Condition	Pavement	1,2,3,4,5	40	
Asset Functional Performance	4	1,2,3,4,5	20	
Total score	12		60	
Asset condition index = (actual score/maximum score) x 100				

Section 3.2 describes the typical components of the road, which needs to be assigned a rating to calculate asset condition index:

- Surface seal
- Pavement base course
- Curb and gutter
- Drainage sumps



But this road does not have curb and gutter and has no drainage sumps. Let's visually assess condition of surface seal and base course pavement

Step 1

- Perform condition assessment to determine PCR of asset components (use Table 2-1 for ratings)



Asset Component Condition	Physical Condition Rating	Interpretation
Asset Component in brand new condition, with no wear, no damage, no deformation, no defects, no deterioration, no impairment	5	Excellent
Asset Component in “like new” condition, with minor wear and no damage, no defects, no deformation, no deterioration and no impairment	4	Good
Asset Component shows minor wear, minor deformation, minor damage, minor defects, minor deterioration, minor impairment, asset condition can be maintained through normal preventative maintenance	3	Fair
Asset Component with major deformation, degradation, deterioration, damage or defects and serious impairment in condition; however component condition can be restored through economically efficient rehabilitation/refurbishment of degraded/faulty components.	2	Poor
Asset Component with major degradation, deterioration, damage or defects and serious impairment in condition, and it is not possible to restore the component condition through economically efficient rehabilitation/refurbishment	1	Very Poor

- Which rating would you give to the surface seal?
- Please discuss within your group and assign a rating.

Step 1

- Perform condition assessment to determine PCR of asset components (use Table 2-1 for ratings)



Asset Component Condition	Physical Condition Rating	Interpretation
Asset Component in brand new condition, with no wear, no damage, no deformation, no defects, no deterioration, no impairment	5	Excellent
Asset Component in “like new” condition, with minor wear and no damage, no defects, no deformation, no deterioration and no impairment	4	Good
Asset Component shows minor wear, minor deformation, minor damage, minor defects, minor deterioration, minor impairment, asset condition can be maintained through normal preventative maintenance	3	Fair
Asset Component with major deformation, degradation, deterioration, damage or defects and serious impairment in condition; however component condition can be restored through economically efficient rehabilitation/refurbishment of degraded/faulty components.	2	Poor
Asset Component with major degradation, deterioration, damage or defects and serious impairment in condition, and it is not possible to restore the component condition through economically efficient rehabilitation/refurbishment	1	Very Poor

- Which rating would you give to the pavement base course?
- Please discuss within your group and assign a rating.

Step 2A

- Establish FPR of asset by assessing recent asset performance (use Table 2-5 in Section 2 for ratings)

We know there has been a high number of public complaints about this road section, indicating it does not meet the expected performance level. Please use **Section 2: Table 2-5** to assign the appropriate functional performance rating to this section of the road.

Table 2-5: Asset Functional Performance Ratings

Asset Functional Performance Rating	Condition Score	Interpretation
Asset's functional performance exceeds the upper limit of the desired service levels.	5	Excellent
Asset's functional performance meets the upper limit of the desired service levels.	4	Good
Asset's functional performance meets the lower limit of the service level requirements.	3	Fair
Asset's functional performance does not meet the lower limit of the service level requirements, however through refurbishment/renewal it is possible to restore the performance to acceptable level.	2	Poor
Asset's functional performance does not meet the lower limit of the service level requirements, and it is not possible to restore the performance to acceptable levels through renewal/refurbishment.	1	Very poor



• Calculate the Asset Condition Index

Now that we have assigned the physical condition and functional performance ratings to this road section, we can input them into **Table 3-4 (Section 3)** to calculate the Asset Condition Index. In the Excel worksheet, insert condition ratings in cells marked with “?” It will calculate the asset condition index.

Table 3-4 (Section 3)

Condition Criteria		Weight	Condition Ratings	Maximum Score	Actual Score
Component Physical	Pavement Base course	4	?	20	#VALUE!
	Surface Seal	4	?	20	#VALUE!
	Curb & Gutter			0	
	Drainage System			0	
Asset Functional		4	?	20	#VALUE!
Total Score		12		60	#VALUE!
Asset Condition Index (ACI) = (Actual Score / Maximum Score) x 100					#VALUE!

Risk of Failure and Remaining Useful Life

Step 3

- Assess the risk of asset failure and remaining useful life Use **Table 2-3 (Section 2)** shown below

Based on the Asset Condition Index value calculated in the previous slide, find the correct row in the first column of the table and then move to column 3 in the same row to find the remaining useful and move to column 4 in the same row to find the risk of asset failure.

Table 2:3 (Section 2)

Asset Condition Index	Interpretation	Remaining Useful Life	Risk of Failure in Service
0 to 20	Very Poor	< 5% of TUL	Very High
21 to 40	Poor	<20% and ≥5% of TUL	High
41 to 60	Fair	<50% and ≥20% of TUL	Moderate
61 to 80	Good	<85% and ≥50% of TUL	Low
81 to 100	Excellent	≥85% of TUL	Very Low

Investment plan

Step 4

- Select the optimal investment plan Use **Table 2-4 (Section 2)** shown below
- Based on the Asset Condition Index value calculated in the previous slide, what is the recommended action?

Table 2-4 (Section 2)

Asset or Component Condition	Recommended Action for Investment Planning
ACI = 0 to 20	Plan Asset Replacement - with High Priority
ACI = 21 to 40	Plan Asset Replacement
ACI > 40, but one or more component's Rating 2 or Less	Plan Renewal of Components with Condition Rating of 2 or Less
ACI > 50 and all components with rating of 3 or higher	Only Scheduled Maintenance and inspections are Required

Cost Estimate for Road Construction

Road Section Dimensions			Units
Length	L	2,000	m
Width	W	8	m
Area	$A = L \times W$	16,000	m^2
Unit Costs for Road Construction(From Section 4)			
Unit cost base pavement (Table 4-4)	C_{bp}	\$5.00	USD/ m^2
Unit cost surface pavement (Table 4-5)	C_{sp}	\$14.00	USD/ m^2
Price Adjustment Factor for Palau (Table 4-2)	P_{af}	1.3	
Cost Estimate			
Estimated Cost of base pavement	$A \times C_{bp} \times P_{af}$	\$ 104,000	USD
Estimated Cost of surface pavement	$A \times C_{sp} \times P_{af}$	\$ 291,200	USD
Total Estimated Cost		\$ 395,200	USD

4.2 Roads

The per-unit construction costs for construction of various components of sealed and unsealed roads are provided in Tables 4-3 through 4.6. These unit costs have been derived through the use of the following references:

- Road construction costs—Australia⁴
- Tuvalu asset management framework
- Nauru Asset Management Framework
- Samoa Land Transport Authority Renewal and Depreciation Funding Gap Assessment

Table 4-3: Per-Unit Building Construction Costs (\$/m²)

Terrain	Flat	Rolling	Steep
Urban	\$17.00	\$22.00	\$39.00
Rural	\$22.00	\$29.00	\$29.00

Table 4-4: Sealed and Unsealed Roads—Per-Unit Cost for Base Pavement (\$/m²)

Road Classification	Assumed Base Depth (mm)		Unit Rates (\$/m ²)	
	Heavy	Standard	Heavy	Standard
Arterial	450	350	\$14.00	\$11.00
Primary collector	350	275	\$11.00	\$9.00
Secondary	250	200	\$8.00	\$6.00
Local	200	150	\$7.00	\$5.00
Unsealed main	150	-	\$5.00	-
Unsealed local	75	-	\$3.00	-

Note: - = not available, mm = millimeter, m² = square meter.

Table 4-5: Sealed Roads—Per-Unit Cost for Surface Seal (\$/m²)

Road Classification	Units of Measurement		
	Chipseal	Asphalt	Asphalt Concrete
Arterial	\$10.00	\$21.00	\$28.00
Primary collector	\$9.00	\$17.00	\$23.00
Secondary	\$8.00	\$14.00	\$18.00
Local	\$7.00	\$14.00	\$18.00

Note: m² = square meter.

The per unit costs indicated in Table 4-6 assume curb cross-section are of 0.12 m² and footpath slab thickness of 100 millimeters (mm).

Table 4-6: Per-Unit Cost for Auxiliary Road Components

Component	Measurement Unit	Unit Cost
Curb and Gutter	\$/m length	\$72.00
Footpath	\$/m ² area	\$60.00
Drainage sump with drain	\$/each	\$1,500.00

Note: m = meter, m² = square meter.

The per unit costs indicated in Tables 4-3 through 4-6 should be multiplied with a country specific correction factor, indicated in Table 4-2, to adjust the prices for freight and economies of scale.

⁴ Australian Government. 2018. Road Construction Cost and Infrastructure Procurement Benchmarking: 2017 Update. Research Report 148. Bureau of Infrastructure, Transport and Regional Economics. Canberra.



Group 1 Exercise Results



Visual Condition Assessment of a section of road:

- Condition Assessment of a 2 km long, 8 m wide, local road section, in Palau revealed the entire road section looks as shown in the photograph, with a large number of pot holes damaging the surface seal as well as the base course pavement.
- There have been numerous public complaints about this road section.

Physical Condition Ratings	
Surface Seal	
Base Course	
Functional Performance Rating	
Asset Condition Index	
Remaining Useful Life	
Risk of Failure	
Estimated Investment	