

Inland Waterway User Board – *“Quantifying, and Using, ‘Total Risk Exposure’ to Revisit CPBM Strategies”*

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CPBM – 2010

Inland Marine Transportation Systems (IMTS) Capital Projects Business Model

Final Report
Revision 1

April 13, 2010



Prepared by:
IMTS Capital Investment Strategy Team

The views and recommendations contained within this report reflect those of the Inland Marine Transportation System Capital Investment Strategy Team and not necessarily those of the Inland Waterways Users Board, the U.S. Army Corps of Engineers, or the Administration.

Revision 1 includes minor formatting and grammatical changes, and acknowledges the Inland Waterways Users Board approval, adoption and subsequent forwarding of the report to the Assistant Secretary of the Army for Civil Works for consideration by the Administration.

Table ES-1. IMTS Investment Strategy Criteria Weighting

Criteria	Phases 1 and 2	Phase 3
Risk and Reliability	40	60
Condition Index for Locks (rated A through F)		
DSAC for Dams (rated 5 through 1)		
Economic Return	60	40
Net Benefits	15	
BCR	5	
RBRCR	25	
Economic Impact	15	40
Totals	100	100

Table 4-8. Total Ranking for the 10 Highest Ranked Projects

Project Name	Subproject Name	Criteria Total	Rank
Olmsted Locks and Dam	Olmsted L/D Construction	90.5	1
Monongahela Locks and Dams 2, 3, and 4	Lower Mon 2,3,4, Dam Features	69.5	2
Monongahela Locks and Dams 2, 3, and 4	Lower Mon 2,3,4, Lock Features	68.8	3
Greenup Lock, Ohio River	Greenup Lock Extension PED	59.0	4
Chickamauga Lock	Chickamauga Replacement Lock	40.2	5
Upper Mississippi & Illinois Waterway, L/D 25	1200' Lock Addition	26.9	6
Upper Mississippi & Illinois Waterway, L/D 22	1200' Lock Addition	26.5	7
Kentucky Lock Addition	Kentucky Lock Addition	26.3	8

Good results using data and information available at that time!!



CPBM (2010) – “Risk & Reliability”

Condition	Definitions
A – Adequate	Limited probability of failure
B – Probably Adequate	Low probability of failure
C – Probably Inadequate	Moderate probability of failure
D – Inadequate	High probability of failure
F – Failed	The feature has FAILED

Figure 4-3. Condition Index

Risk and Reliability DSAC Condition Index Rating	Phase 1 and 2	Phase 3
1 F	40	60
2 D	25	45
3 C	10	30
4 B	5	10
5 A	0	0

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“Risk and Reliability” based on Condition description, and simple weighting, at top asset level, i.e. the Lock or Dam



CPBM (2010) – “Economic Impact”

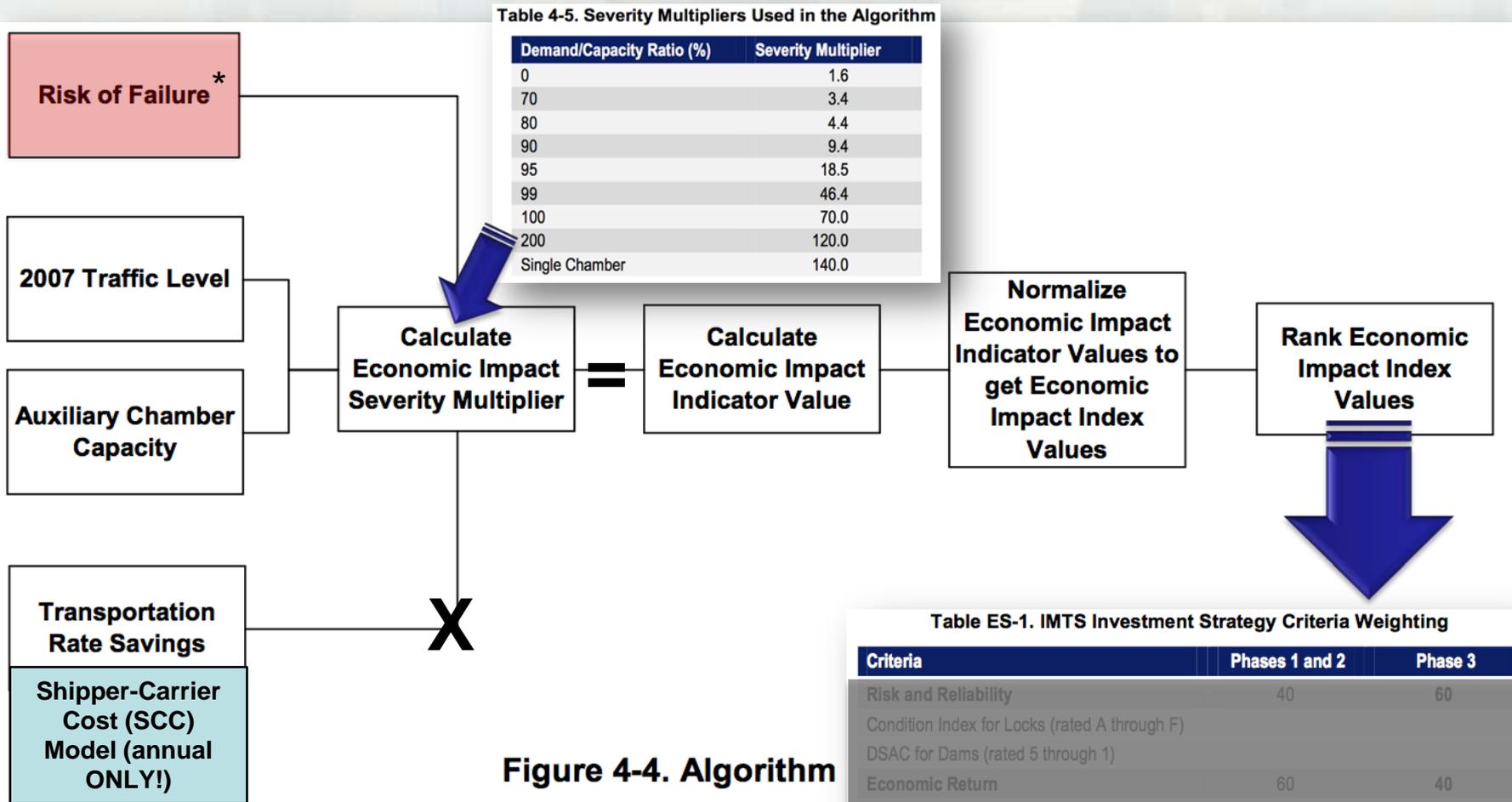


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* CPBM Report – “It should be noted that although the Algorithm allows for consideration of risk of failure, that feature was not used in this analysis because the probabilities have not yet been developed.”

3.1 The Future Capital Project Business Model

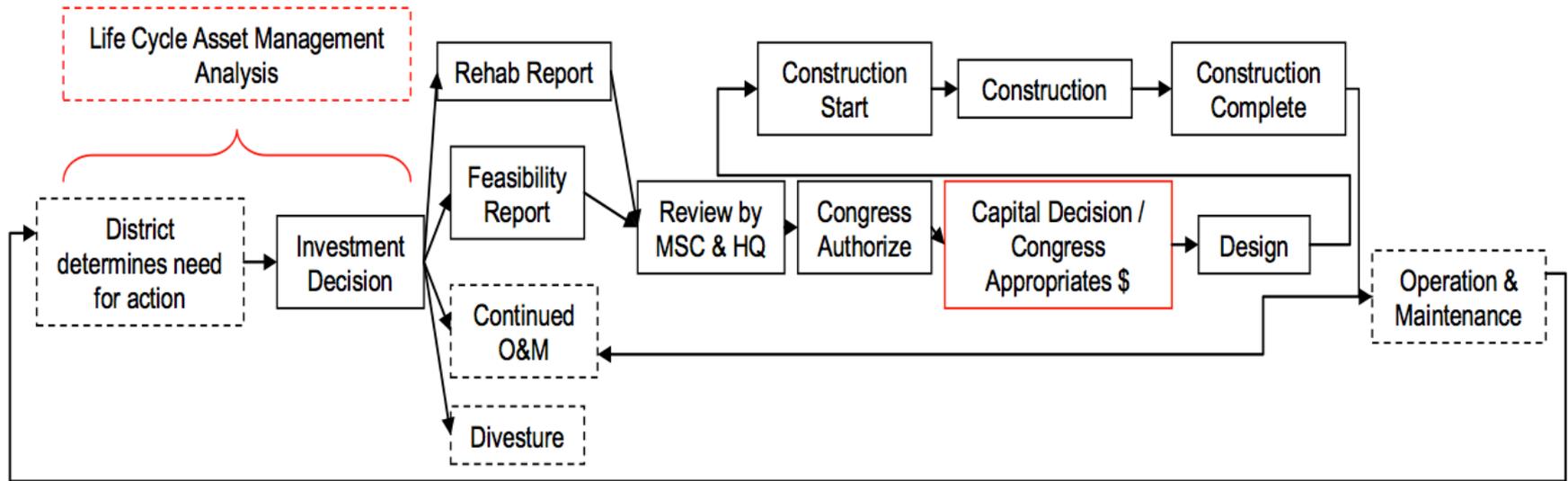


Figure 3-1. Future Capital Projects Business Model

The future capital project business model, as shown in Figure 3-1, changes the status quo in two main areas. First, life-cycle asset management analysis will provide criteria for project prioritization, and second, the capital decision will use the prioritization to make decisions on where to best allocate constrained funding to provide for the best IMTS.



Then → Now

CPBM 2010

1. Single Condition – *only* at Lock and Dam “top level”
2. “Risk of Failure” *not* considered
3. SCC Model *only* used for *Annual* Transportation Rate Savings

The future capital project business model, as shown in Figure 3-1, changes the status quo in two main areas. First, life-cycle asset management analysis will provide criteria for project prioritization, and second, the capital decision will use the prioritization to make decisions on where to best allocate constrained funding to provide for the best IMTS.

Life Cycle Asset Management

1. Condition assessments for 166,000 components across entire IMTS!
2. Baseline Failure Curves!
3. Economic impacts from SCC Model considering various intervals of unscheduled outages from 1 to 365 days!

Can use all of the above to determine the **Total Risk Exposure** for EACH Site in IMTS!!

“Best IMTS” = Lower “Total Risk Exposure” (TRE)



USACE AM Total Risk Exposure (TRE)

Assigning Condition Ratings

CONDITION RATING	EXAMPLE	DEFINITION
A	EXCELLENT	There is no need for any repair or replacement of the component. The component is in excellent condition and is performing as intended.
B	GOOD	There is no need for any repair or replacement of the component. The component is in good condition and is performing as intended.
C	FAIR	There is a need for minor repair or replacement of the component. The component is in fair condition and is performing as intended.
D	POOR	There is a need for major repair or replacement of the component. The component is in poor condition and is performing as intended.
F	FAILURE	There is a need for immediate repair or replacement of the component. The component is in failure condition and is not performing as intended.

Consistent and Repeatable Process!

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Total Risk Exposure is composed of:

“Residual Risk” – Components in “A” & “B” condition that *currently* do NOT show impacts on mission performance (including components that have been Repaired/Replaced)

“Operational Risk” – Components in “C” thru “F” condition that *currently* show impacts on mission performance

For EACH IMTS Site (to Component level):

Inventory Condition \times P(f)



Econ Impact on Shippers and Carriers = Risk (@ Component level)

\times



$\Sigma = \text{TRE}$

Each IMTS Site will have varying degrees of Operational and Residual Risk which can inform Investment Strategies



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Spectrum of Investment Strategies

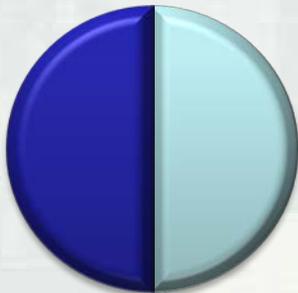
Risk Exposure Levels

Investment Strategy



HIGH Residual Risk Exposure
LOW Operational Risk Exposure =

Strategic Maintenance
Management



SIMILAR Residual Risk Exposure
SIMILAR Operational Risk Exposure =

?? Maintain OR
Restore??



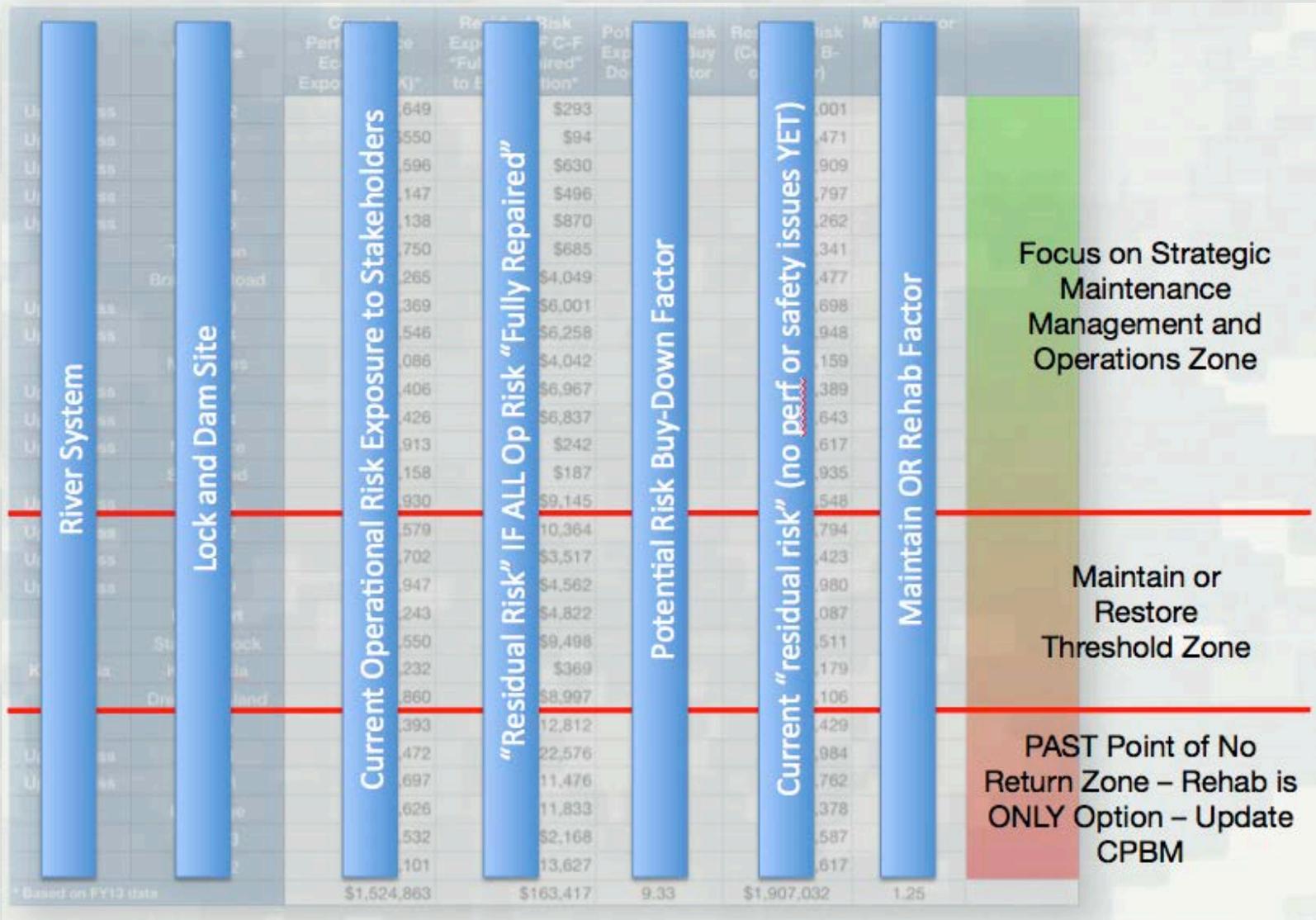
LOW Residual Risk Exposure
HIGH Operational Risk Exposure =

Past the “Point of No
Return?” – Rehab
best option

...and everything in between...



Application to Subset of the IMTS



In Summary

Life Cycle Asset Management Analysis using:

1. Condition assessments for 166,000 components across entire IMTS!
2. Baseline Failure Curves!
3. Economic impacts from SCC Model considering various intervals of unscheduled outages from 1 to 365 days!

Enables...

Development of **Total Risk Exposure**, including Operational and Residual Risk, at EACH IMTS Site

Which Provides a...

Risk-Informed **Project Prioritization** and Overall Portfolio Investment Strategies

That...

Provides for the **BEST IMTS**

Approach Consistent with ISO 31000 "Risk Management" and Portfolio Management in Financial Sector



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Questions?

