Risk-based Decision Making (RBDM) in the Field: Ten Common Risk Questions Answered

This article is the third in the series and provides a quick review of Risk-based Decision Making. Our goal is to further introduce you to RBDM by providing answers to the most commonly asked questions, while staying clear of most theory and background (you can find specific details in G-M's second edition of the RBDM Guidelines *and throughout this website).*

1. WHY SHOULD I CARE ABOUT RBDM?

Risk management is a cornerstone of the Marine Safety and Environmental Protection Business Plan. Various field units are applying RBDM to some of their most important (or otherwise high-profile) decision-making processes. Examples include the following:

- Risk-based Business Planning at MSO Charleston
- Vessel Relative Ranking/Risk Indexing at MSO Jacksonville
- Port Daily Risk at MSO Los Angeles/Long Beach

G-MSE and the R&D Center have upgraded the original version of the *RBDM Guidelines* with a second edition and have been conducting RBDM application workshops at field units around the country. In addition, other program offices have undertaken RBDM efforts such as the following:

- Port and Waterway Safety Assessments (PAWSA)
- Waterway Evaluation Tool (WET)
- Ecological Risk Assessment (ERA) Principles Applied to Oil Spill Response Planning

The Marine Safety School in Yorktown includes a 4-hour module on risk management in some of its courses. More broadly, the Federal government has adopted performance-based management strategies that demand risk-based decision making about regulatory development and enforcement. Even the well-established marine industry is adopting risk management principles (e.g., the Passenger Vessel Association [PVA] Risk Guide). Indeed, everyone really is talking about and acting on RBDM.

2. OK, SO WHAT IS RBDM?

"Risk-based decision making is a process that organizes information about the possibility for one or more unwanted outcomes to occur into a broad, orderly structure that helps decision makers make more informed management choices." More simply stated, RBDM asks the following questions and uses the answers in the decision-making process:

- What can go wrong?
- How likely are the potential problems to occur?
- How severe might the potential problems be?
- Is the risk of potential problems tolerable?
- What can/should be done to lessen the risk?

3. BUT WE ALREADY CONSIDER THIS, DON'T WE?

Of course! We make hundreds of decisions every day. For almost every decision, there is some chance of an unwanted outcome. We include this possibility in our decisions; sometimes informally (when we change lanes on the interstate) and sometimes formally (when we perform calculations to decide how much insurance to buy). Increasingly, the world is demanding more structured and more defensible decisions (especially where risk is involved). At the same time, systems and operations are becoming more complex, making intuitive risk management decisions more difficult and less reliable.

RBDM adds to your decision-making process a systematic consideration of diverse risks that may be important to various stakeholders. A wide range of risk analysis tools (from very simple to very sophisticated) is available to help you develop just the right information about risks to support your decision making. The question is not, "Should I use risk-based decision making?" The question is, "How should I use risk-based decision making?" The key is to focus on using the most suitable tool(s) for your situation.

4. WHAT TOOLS?

Many unique approaches exist for studying how operations are performed and how equipment is configured to find weaknesses that could lead to accidents. Most of these tools also help measure the risk of potential problems so that you can focus appropriate attention/resources on the issues of greatest concern. Some of the tools also help investigate accidents that have already occurred. The second edition of the *RBDM Guidelines* describes in detail (with worked examples) how and when to apply many risk analysis tools.

But RBDM is really not about the tools; it is about supplying the right information for your decision-making process. We do not want to be led by our tools; the tools (if used at all) must serve us by providing (in a timely manner) the types of information that will influence the decision.

5. SO HOW DOES RBDM WORK?

Regardless of how formally you address risk-based decision making or the specific tools you use, risk-based decision making is made up of the five major components shown in Figure 1.

Risk-based Decision Making

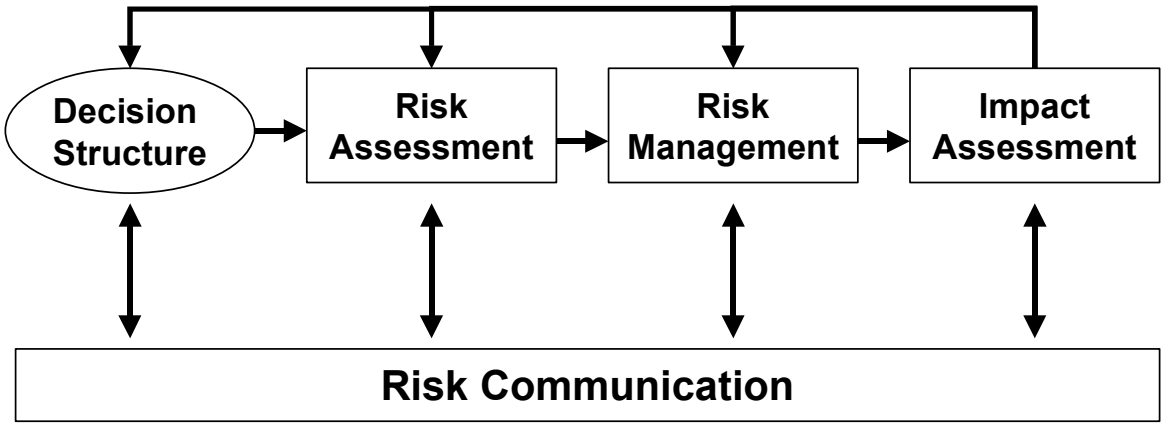


Figure 1 Risk-based Decision-making Process

The second edition of the *RBDM Guidelines* provides a good description of each of these elements of risk-based decision making.

6. I HAVE SEEN THIS BEFORE, BUT HOW DOES IT REALLY WORK?

We promised a step-by-step example of the RBDM process from the field to help you understand how RBDM really works. This example is based on a real RBDM application at a field unit.

Imagine that you work in the marine inspection department at a Marine Safety Office (MSO). Among other duties, your unit is responsible for deciding whether to require a simplified stability test for small passenger vessels (vessels carrying fewer than 49 passengers) in your zone. A number of existing vessels that carry a significant number of passengers (up to 49) and operate on an ocean route (100 miles from shore) have never had a stability evaluation done (either a simplified stability test or formal evaluation for sister-ship status). These vessels are not required to have a stability evaluation by either regulation or local policy. For these vessels, your unit is posing the following fundamental question:

> *"For which vessels is a stability evaluation warranted because the potential benefit of detecting an unknown stability deficiency would outweigh the vessel owner's cost of conducting the evaluation?"*

What might the RBDM process for this decision look like? The tables on the following pages illustrate the steps applied by the unit for this decision-making process.

Step 1: Establish the Decision Structure	
Step 1a: Define the decision	
Description: Specifically describe what decision(s) must be made. Major categories of decisions include (1) accepting or rejecting a proposed facility or operation, (2) determining who and what to inspect, and (3) determining how to best improve a facility or operation.	**Example Result:** The Officer-in-Charge, Marine Inspections (OCMI) can require stability evaluations of new and existing vessels if stability is in question. The unit defined the decision as follows: "For which vessels is a stability evaluation warranted because the potential benefit of detecting an unknown stability deficiency would outweigh the vessel owner's cost of conducting the evaluation?"
Step 1b: Determine who needs to be involved in the decision	
Description: Identify and solicit involvement from key stakeholders who (1) should be involved in making the decision or (2) will be affected by actions resulting from the decision-making process.	**Example Result:** The unit decided that the OCMI, the inspection department, and the USCG Marine Safety Center were the key stakeholders involved in making the decision. They also chose to involve a marine engineering consultant on vessel stability. The RBDM team also knew that the potentially affected vessel owners/operators were stakeholders and should be involved through special outreach efforts (see the description under "*All Steps: Facilitate Risk Communication*").
Step 1c: Identify the options available to the decision maker	
Description: Describe the choices available to the decision maker. This will help focus efforts only on issues likely to influence the choice among credible alternatives.	**Example Result:** The unit decided that the following options were available to the decision maker: ▪ Require simplified stability tests for all vessels ▪ Require simplified stability tests only where indicated by regulations ▪ Require simplified stability tests only for "high risk" vessels or as specifically required by regulations

Step 1: Establish the Decision Structure (continued)

Step 1d: Identify the factors that will influence the decision (including risk factors)

Description:

Few decisions are based on only one factor. Most require consideration of many factors, including costs, schedules, risks, etc., at the same time. The stakeholders must identify the relevant decision factors.

Example Result:

The unit identified the following decision factors:

- Vessel instability risk, based on:
  - Route
  - Operations
  - Design
  - Modifications
  - Vessel history
- Cost of conducting simplified stability tests (including actual testing and loss of service time)

The unit did note a few special cases that warranted prescriptive decisions:

- Never require a stability test for a powered catamaran
- Never require a stability test for a vessel with a true sister ship (whose stability is already established)
- Always require a stability test for a vessel on an exposed route
- Always require a stability test if a vessel has had a >2% aggregate weight change

Step 1e: Gather information about the factors that influence stakeholders

Description:

Perform specific analyses (e.g., risk assessments and cost studies) to measure against the decision factors.

Example Result:

The unit understood the approximate cost of simplified stability tests and the associated loss of service time for vessels. The team chose not to evaluate this factor further.

Instead, the unit focused on measuring relative risks of vessel instability among new and existing vessels in the unit's zone. The unit decided to use a risk assessment process (as described in Step 2) to measure the relative risks.

Step 2: Perform the Risk Assessment

Step 2a: Establish the risk-related questions that need answers

Description:	**Example Result:**
Decide what questions, if answered, would provide the risk insights needed by the decision maker.	The unit decided that the basic risk-related question was as follows: "What combination of vessel and operational characteristics poses significant vessel instability risks that might require a simplified stability test?"

Step 2b: Determine the risk-related information needed to answer the questions

Description:	**Example Result:**
Describe the information necessary to answer each question posed in the previous step. For each information item, specify the following: • Information type needed • Precision required • Certainty required • Analysis resources (staff-hours, costs, etc.) available	*Information Type Needed* A risk index number is needed for measuring the risk of an unknown instability for a given vessel and operational condition. *Precision Required* The index number does not have to be highly precise (e.g., integer values), but the risk factors considered must be defined very specifically. *Certainty Required* The RBDM team needs to have high confidence that high index scores reflect high risk and low index scores reflect low risk, recognizing that some intermediate scores may represent a gray area where the risk is unclear. *Analysis Resources Available* Application of the risk scoring process to a particular vessel must be very efficient (e.g., requiring only a few minutes to apply) and must not require a risk analysis expert. However, the unit was willing to spend a couple of days developing a risk analysis job aid.

Step 2c: Select the risk analysis tool(s)

Description:	**Example Result:**
Select the risk analysis tool(s) that will most efficiently develop the required risk-related information.	Based on the decision-making situation and the type of information needed, the unit decided to create a simple **relative ranking/risk indexing tool** (as described in the second edition of the *RBDM Guidelines*). The team also used **event tree analysis** to help ensure that the right risk factors were built into the index tool. *(A copy of the index tool is provided at the end of this article.)* The team determined that the following actions should be taken for certain risk index values: ▪ **-4 or less:** No stability test required ▪ **+4 or greater:** Stability test required ▪ **-4 to +4:** Use discretion in deciding

Step 2: Perform the Risk Assessment (continued)	
Step 2d: Establish the scope for the analysis tool(s)	
Description: Set any appropriate physical or analytical boundaries for the analysis.	**Example Result:** The unit focused only on vessels for which stability tests were not specifically required by regulations. The unit's analysis considered only the risk factors that the team explicitly built into the risk index tool (i.e., no other brainstorming was performed). In addition, the unit did not apply the tool to powered catamarans, vessels with true sister ships, or vessels on exposed routes because the decisions for these vessels would not be affected by the risk scores (as mentioned previously).
Step 2e: Generate risk-based information using the analysis tool(s)	
Description: Apply the selected risk analysis tool(s). This may require the use of more than one analysis tool and may involve some iterative analysis (i.e., starting with a general, low-detail analysis and progressing toward a more specific, high-detail analysis).	**Example Result:** First, the unit applied the risk index tool to a number of test case vessels to ensure that the tool was "tuned" properly. The unit compared the resulting risk priorities to its own subjective priorities assigned from experience. Based on these tests, the unit made some revisions to the index tool. This reality check helped validate the tool before it is used in actual RBDM applications for vessels. Then, the unit began applying the risk-indexing tool for specific vessels needing stability test determinations. The unit uses the results to help make risk management decisions for each vessel. Vessel owners/operators (or their representatives) are directly involved with unit personnel in this process.

Step 3: Apply the Results to Risk Management Decision Making

Step 3a: Assess possible risk management options

Description:	**Example Result:**
Determine how the risks can be managed most effectively. This decision can include (1) accepting/rejecting the risk or (2) finding specific ways to reduce the risk.	For each vessel, the unit looks for simple vessel configuration or operational changes that might make stability testing unnecessary, especially when a preliminary analysis indicates that testing may be required (or if the decision is unclear). Once improvement options have been fully considered, the team uses the final risk index value to help make a decision about stability testing.

Step 3b: Use risk-based information in decision making

Description:	**Example Result:**
Use the risk-related information within the overall decision framework to make an informed, rational decision. This final decision-making step often involves significant communication with a broad set of stakeholders.	For vessels with extreme risk index scores (above +4 or below –4), the index score drives the decision as described previously. For intermediate scores, the stakeholders discuss how severely the cost of the stability test and the interruption in service time would affect the owner/operator. The OCMI ultimately determines whether a stability test will be required. A flowchart of the overall decision-making process, which also addresses vessels not scored using the index tool, is included at the end of this article.

Step 4: Monitor Effectiveness Through Impact Assessment

Description:	**Example Result:**
Track the effectiveness of actions taken to manage risks. The goal is to verify that the organization is getting the expected results from its risk management decisions. If not, a new decision-making process must be considered.	The unit is monitoring the long-term results of decisions made using this RBDM process. If (1) stability issues arise that were not predicted by the index tool or (2) other exclusions from the use of the tool become evident, the unit will revisit the RBDM process and make appropriate improvements.

All Steps: Facilitate Risk Communication

Description:	**Example Result:**
Encourage two-way, open communication among all stakeholders so that they will: ▪ Provide guidance on key issues to consider ▪ Provide relevant information needed for assessments ▪ Provide buy-in for the final decisions	The unit directly involved the important stakeholders within the USCG in the process. The vessel owners/operators were involved at various stages of the RBDM process through the following: ▪ An initial kickoff meeting to gather ideas, discuss issues, and solicit other input ▪ A review meeting to present a draft of the USCG's RBDM framework and index tools and to solicit comments ▪ Widespread distribution of the final RBDM framework and index tools before actual use ▪ Owner/operator participation in individual vessel reviews

7. SEEMS EASY ENOUGH; IS RBDM HARD TO IMPLEMENT?

Actually, the RBDM process is relatively straightforward and intuitive. Learning how to apply some of the risk analysis tools does take some effort, and some of the more sophisticated tools are actually quite complex. Sometimes, knowing where to get data to support your analyses can be difficult. However, for most of the situations you are likely to encounter, providing pertinent risk information to decision makers is easily within your grasp.

8. WILL I REALLY SEE ANY BENEFITS?

You should see three benefits from structured RBDM:

1. A common decision-making process that your peers and superiors will already understand and expect

2. Decisions that you can more easily defend because of the process you followed and the stakeholders you involved

3. A systematic process that will reveal valuable information, which may lead to different solutions

The first two benefits are important, but hard to quantify. The third benefit can save lives, protect the environment, and promote commerce, but it will not be realized in all applications. This is because (1) less informed decisions often produce good results (e.g., 50% of the time, the toss of a coin will result in the "right" outcome among two options) and (2) sometimes the additional information gathered simply reinforces the experienced judgment of the decision maker.

Remember, you can (and should) tailor the RBDM process to be as simple as possible (maybe even only a mental checklist) for your application. If you are not using a systematic RBDM process, you need to ask yourself one question: "Do I feel lucky?"

9. HOW DO I GET STARTED ON AN ISSUE RELATED TO MY JOB?

The best way to get started is to become familiar with the second edition of the *RBDM Guidelines*. Much care and effort went into making this a practical, hands-on guide to help you structure your RBDM applications and perform related risk analyses. The *RBDM Guidelines* provide a valuable mix of RBDM fundamentals, step-by-step analysis procedures (with worked examples), and resources (including full example analyses). The "RBDM Navigator" (Volume 1 of the *RBDM Guidelines*) guides you to information you need for your application. Other resource information is available on the G-MSE website.

10. WHERE CAN I TURN FOR HELP?

G-MSE can point you in the right direction and provide additional guidance/support as needed.

ANY LAST ADVICE?

Remember, the ultimate question is not, "Should I use risk-based decision making?" The question is, "How should I use risk-based decision making most effectively to meet my needs?" Your emphasis should be on providing urgently needed information using the most suitable tools for the situation, not just following one approach.

Each application you face will have to be context specific. Our experience shows that the best way to build the right structure for getting the information you need is through a systematic risk-based decision-making process. With such a clear blueprint for building the right risk-related information, you should be able to select the right mix of tools and successfully apply RBDM.

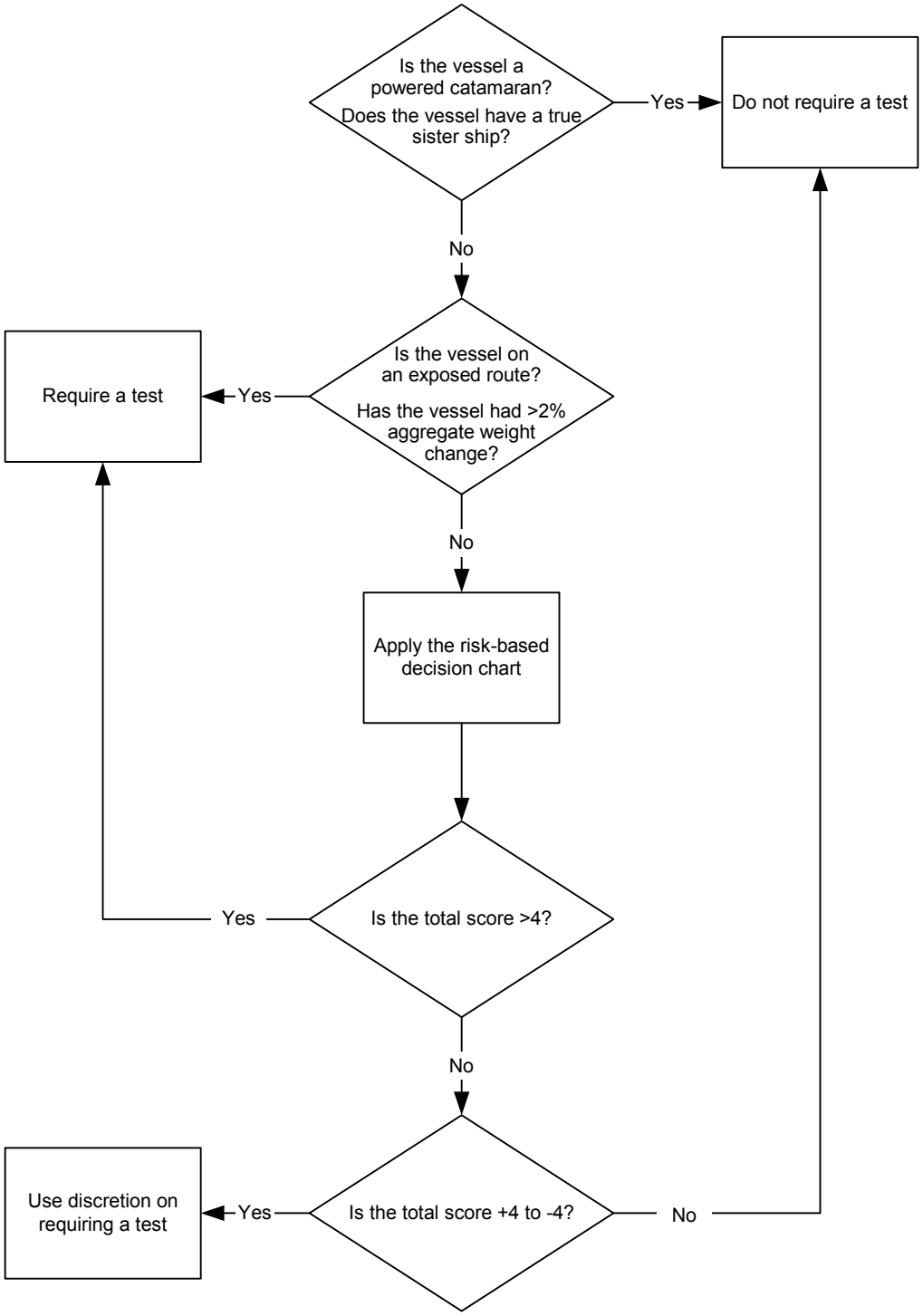
ATTACHMENT

Risk-based Job Aid for Requiring a Simplified Stability Test on Small Passenger Vessels

Part I – Flowchart
Part II – Scoring Chart

Risk-based Job Aid for Requiring a Simplified Stability Test on Small Passenger Vessels

Part I – Flowchart



Risk-based Job Aid for Requiring a Simplified Stability Test on Small Passenger Vessels

Part II – Scoring Chart

Vessel Name: _____

O.N.: _____ Date: _____

Factor	*Subfactors*	*Scoring Scheme*		*Vessel Score*
		Category ***(Benchmark)***	**Weighted Score**	
Route	• Exposed • Partially protected ➢ 3 miles from shore – 20 miles from harbor of safe refuge ➢ < 3 miles from shore ➢ < 1,000 feet from shore • Protected ➢ < 1,000 feet from shore ➢ Rivers ➢ Shallow water *Note: If the vessel is on an exposed route, then require a test*	Significant increase (3 miles from shore – 20 miles from harbor of safe refuge)	8	
		Moderate increase (< 3 miles from shore)	4	
		Neutral	0	
		Moderate decrease	-4	
		Significant decrease (protected shallow water < 1,000 feet from shore)	-8	
Operations	• Service ➢ Charter (best) ➢ Excursion (worst) • Loading ➢ Number of passenger decks • Three or more (worst) • Two • One (best) ➢ Passenger ➢ Cargo • Number of passengers ➢ 49 (worst) ➢ < 15 (best)	Significant increase (excursion vessel with 49 passengers)	8	
		Moderate increase	4	
		Neutral (~ 20 passengers and charter boat)	0	
		Moderate decrease	-4	
		Significant decrease (charter, < 15 passengers, no cargo, and 1 passenger deck)	-8	

Risk-based Job Aid for Requiring a Simplified Stability Test on Small Passenger Vessels

Part II – Scoring Chart (cont'd)

Factor	*Subfactors*	*Scoring Scheme*		*Vessel Score*
		Category *(Benchmark)*	**Weighted Score**	
Design	• Unusual proportion and form ➢ See MSC • Openings ➢ Vents, drains, etc., are not water tight • Construction ➢ Steel ➢ Aluminum ➢ Fiberglass ➢ Wood • Number of centerline and/or unbaffled tanks • Type ➢ Flush deck (best) ➢ Well deck ➢ Cockpit ➢ Open boat (worst) • Coamings • Sister ship • Subdivision • Collision bulkheads *Note: If the vessel is a powered catamaran or has a true sister ship, do not require a test*	Significant increase (wooden and open boat)	6	
		Moderate increase (wooden boat)	3	
		Neutral	0	
		Moderate decrease (either sister ship or subdivision)	-3	
		Significant decrease (sister ship and subdivision)	-6	
Modification	• Change in weight • Shifted weight • Change in wind profile *Note: If > 2% aggregate weight change, then require a test*	Significant increase (up to 2% aggregate weight change)	4	
		Moderate increase	2	
		Neutral (little or no increase)	0	
		Moderate decrease	-2	
		Significant decrease (moved weight from high to lower location and reduced sail area)	-4	
Vessel history	• Years of satisfactory operation ➢ Preventive maintenance in place ➢ Structural defects ➢ Groundings ➢ Operational violations ➢ Marine violations ➢ Marine casualties	Significant increase (multiple-year history of structural defects)	4	
		Moderate increase (sporadic structural defects)	2	
		Neutral (0 to 4 years of satisfactory operation)	0	
		Moderate decrease (5 to 10 years of satisfactory operation)	-2	
		Significant decrease (> 10 years of satisfactory operation)	-4	
			Total Vessel Score* =	

*Decision criteria based on total vessel score: if < -4, then do not require a test; if -4 to 4, then use discretion; if > 4, then require a test.