Appendix N: Guidance on Technical Peer Reviews/Inspections

Introduction

The objective of technical peer reviews/inspections is to remove defects as early as possible in the development process. Peer reviews/inspections are a well defined review process for finding and fixing defects, conducted by a team of peers with assigned roles, each having a vested interest in the work product under review. Peer reviews/inspections are held within development phases, between milestone reviews, on completed products or completed portions of products. The results of peer reviews/inspections can be reported at milestone reviews. Checklists are heavily utilized in peer reviews/inspections to improve the quality of the review.

Technical peer reviews/inspections have proven over time to be one of the most effective practices available for ensuring quality products and on-time deliveries. Many studies have demonstrated their benefits, both within NASA and across industry. Peer reviews/inspections improve quality and reduce cost by reducing rework. The studies have shown that the rework effort saved not only pays for the effort spent on inspections, but also provides additional cost savings on the project. By removing defects at their origin (e.g., requirements and design documents, test plans and procedures, software code, etc.), inspections prevent defects from propagating through multiple phases and work products, and reduce the overall amount of rework necessary on projects. In addition, improved team efficiency is a side effect of peer reviews/inspections (e.g., by improving team communication, more quickly bringing new members up to speed, and educating project members about effective development practices).

How to Perform Technical Peer Reviews/Inspections

Figure N-1 shows a diagram of the peer review/inspection stages, and the text below the figure explains how to perform each of the stages. (Figure N-2, at the end of the

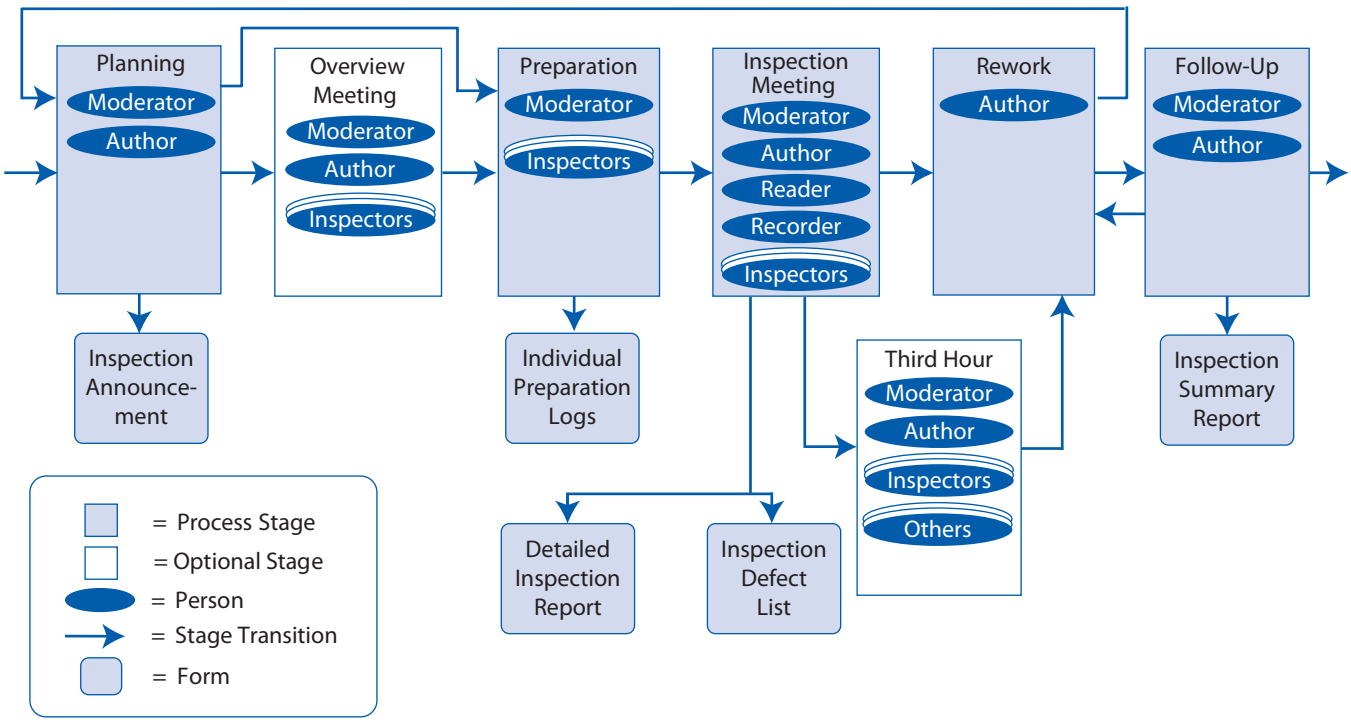


Figure N-1 The peer review/inspection process

appendix, summarizes the information as a quick reference guide.)

It is recommended that the moderator review the Planning Inspection Schedule and Estimating Staff Hours, Guidelines for Successful Inspections, and 10 Basic Rules of Inspections in Figure N-2 before beginning the planning stage. (Note: *NPR 7150.2, NASA Software Engineering Requirements* defines Agency requirements on the use of peer reviews and inspections for software development. NASA peer review/inspection training is offered by the NASA Office of the Chief Engineer.)

> Note: Where activities have an *, the moderator records the time on the inspection summary report.

A. Planning

The moderator of the peer review/inspection performs the following activities.[1]

1. Determine whether peer review/inspection entrance criteria have been met.
2. Determine whether an overview of the product is needed.
3. Select the peer review/inspection team and assign roles. For guidance on roles, see Roles of Participants in Figure N-2 at the end of this appendix. Reviewers have a vested interest in the work product (e.g., they are peers representing areas of the life cycle affected by the material being reviewed).
4. Determine if the size of the product is within the prescribed guidelines for the type of inspection. (See Meeting Rate Guidelines in Figure N-2 for guidelines on the optimal number of pages or lines of code to inspect for each type of inspection.) If the product exceeds the prescribed guidelines, break the product into parts and inspect each part separately. (It is highly recommended that the peer review/inspection meeting not exceed 2 hours.)
5. Schedule the overview (if one is needed).
6. Schedule peer review/inspection meeting time and place.
7. Prepare and distribute the inspection announcement and package. Include in the package the product to be reviewed and the appropriate checklist for the peer review/inspection.
8. Record total time spent in planning.*

B. Overview Meeting

1. Moderator runs the meeting, and the author presents background information to the reviewers.
2. Record total time spent in the overview.*

C. Peer Review/Inspection Preparation

1. Peers review the checklist definitions of defects.
2. Examine materials for understanding and possible defects.
3. Prepare for assigned role in peer review/inspection.
4. Complete and turn in individual preparation log to the moderator.
5. The moderator reviews the individual preparation logs and makes Go or No-Go decision and organizes inspection meeting.
6. Record total time spent in the preparation.*

D. Peer Review/Inspection Meeting

1. The moderator introduces people and identifies their peer review/inspection roles.
2. The reader presents work products to the peer review/inspection team in a logical and orderly manner.
3. Peer reviewers/inspectors find and classify defects by severity, category, and type. (See Classification of Defects in Figure N-2.)
4. The recorder writes the major and minor defects on the inspection defect list (for definitions of major and minor, see the Severity section of Figure N.2).
5. Steps 1 through 4 are repeated until the review of the product is completed.
6. Open issues are assigned to peer reviewers/inspectors if irresolvable discrepancies occur.
7. Summarize the number of defects and their classification on the detailed inspection report.
8. Determine the need for a reinspection or third hour. Optional: Trivial defects (e.g., redlined documents) can be given directly to the author at the end of the inspection.

[1] Langley Research Center, *Instructional Handbook for Formal Inspections*. This document provides more detailed instructions on how to perform technical peer reviews/inspections. It also provides templates for the forms used in the peer review/inspection process described above: inspection announcement, individual preparation log, inspection defect list, detailed inspection report, and the inspection summary report.

9. The moderator obtains an estimate for rework time and completion date from the author, and does the same for action items if appropriate.
10. The moderator assigns writing of change requests and/or problem reports (if needed).
11. Record total time spent in the peer review/inspection meeting.*

E. Third Hour

1. Complete assigned action items and provide information to the author.
2. Attend third hour meeting at author's request.
3. Provide time spent in third-hour to the moderator.*

F. Rework

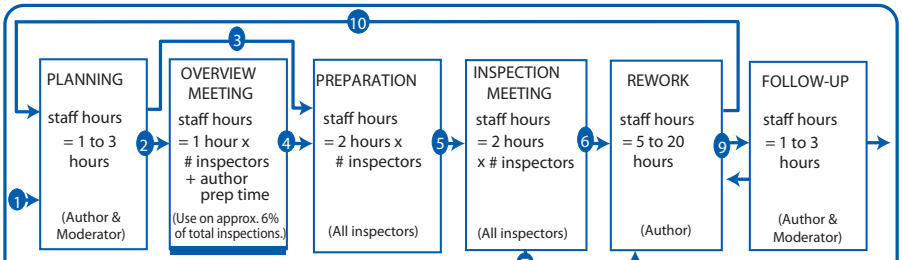
1. All major defects noted in the inspection defect list are resolved by the author.
2. Minor and trivial defects (which would not result in faulty execution) are resolved at the discretion of the author as time and cost permit.
3. Record total time spent in the rework on the inspection defect list.

G. Followup

1. The moderator verifies all major defects have been corrected and no secondary defects have been introduced.
2. The moderator ensures all open issues are resolved and verifies all success criteria for the peer review/inspection are met.
3. Record total time spent in rework and followup.*
4. File the inspection package.
5. The inspection summary report is distributed.
6. Communicate that the peer review/inspection has been passed.

Peer Reviews/Inspections

QUICK REFERENCE GUIDE



Planning Inspection Schedule* and Estimating Staff Hours

TRANSITION TIMES**

1. 1-day minimum
2. 5-day minimum, when included
3. 3- to 5-day minimum for inspectors to fit preparation time into normal work schedule
4. 3- to 5-day minimum for inspectors to fit preparation time into normal work schedule
5. 4 hour minimum prior to inspection meeting
6. Immediate: Rework can begin as soon as inspection meeting ends
7. 1 day recommended
8. Minimum possible time
9. 1-week maximum from end of Inspection meeting
10. 2-week maximum

* Historically, complete inspections have averaged 30.5 total staff hours for 5-person teams.
** Entire inspection process should be completed from start to finish within a 3-week period.

Meeting Length	
• Overview*	0.5 to 1hrs
• Inspection	2 hrs Max.
• Third Hour	1 to 2 hrs

*Author Preparation for Overview: 3 to 4 hrs over 3 to 5 working days

SYMBOLS
= PROCESS STAGE
= OPTIONAL STAGE
= TIME REFERENCE
= STAGE TRANSITION

Types of Inspections

SY1	System Requirements
SY2	System Design
SU1	Subsystem Requirements
SU2	Subsystem Design
R1	Software Requirements
I0	Architectural Design
I1	Detailed Design
I2	Source Code
IT1	Test Plan
IT2	Test Procedures & Functions

Classification of Defects

Severity

Major

- An error that would cause a malfunction or prevents attainment of an expected or specified result.
- Any error that would in the future result in an approved change request or failure report.

Minor

- A violation of standards, guidelines, or rules that would not result in a deviation from requirements if not corrected, but could result in difficulties in terms of operations, maintenance, or future development.

Trivial

- Editorial errors such as spelling, punctuation, and grammar that do not cause errors or change requests. Recorded only as redlines. Presented directly to author.

Author is required to correct all major defects and should correct minor and trivial defects as time and cost permit.

Category

• **Missing** • **Wrong** • **Extra**

Type

Types of defects are derived from headings on checklist used for the inspection. Defect types can be standardized across inspections from all phases of the life cycle. A suggested standard set of defect types are:

- Clarity
- Completeness
- Compliance
- Consistency
- Correctness/ Logic
- Data Usage
- Fault Tolerance
- Functionality
- Interface
- Level of Detail
- Maintainability
- Performance
- Reliability
- Testability
- Traceability
- Other

EXAMPLE
The following is an example of a defect classification that would be recorded on the Inspection Defect List:

Description	Classification			
Line 169 – While counting the number of leading spaces in variable NAME, the wrong "I" is used to calculate "J."	Major Defect	X	Missing	
	Minor Defect		Wrong	X
	Open Issue		Extra	
	Type	Data Usage		
	Origin			

Guidelines for Successful Inspections

- Train moderators, inspectors, and managers
- No more than 25% of developers' time should be devoted to inspections
- Inspect 100% of work product
- Be prepared
- Share responsibility for work product quality
- Be willing to associate and communicate
- Avoid judgmental language
- Do not evaluate author
- Have at least one positive and negative input
- Raise issues; don't resolve them
- Avoid discussions of style
- Stick to standard or change it
- Be technically competent
- Record all issues in public
- Stick to technical issues
- Distribute inspection documents as soon as possible
- Let author determine when work product is ready for inspection
- Keep accurate statistics

10 Basic Rules of Inspections

- Inspections are carried out at a number of points inside phases of the life cycle. Inspections are not substitutes for milestone reviews.
- Inspections are carried out by peers representing areas of life cycle affected by material being inspected (usually limited to 6 or fewer people). All inspectors should have a vested interest in the work product.
- Management is not present during inspections. Inspections are not to be used as a tool to evaluate workers.
- Inspections are led by a trained moderator.
- Trained inspectors are assigned roles.
- Inspections are carried out in a prescribed series of steps.
- Inspection meeting is limited to 2 hours.
- Checklists of questions are used to define task and to stimulate defect finding.
- Material is covered during inspection meeting within an optional page rate, which has been found to give maximum error-finding ability.
- Statistics on number of defects, types of defects, and time expended by engineers on inspections are kept.

Meeting* Rate Guidelines for Various Inspection Types

Type	Inspection Meeting	
	Target per 2 Hrs	Range per 2 Hrs
R0	20 pages	10 to 30 pages
R1	20 pages	10 to 30 pages
I0	30 pages	20 to 40 pages
I1	35 pages	25 to 45 Pages
I2	500 lines of source code**	400 to 600 lines of source code**
IT1	30 pages	20 to 40 pages
IT2	35 pages	25 to 45 pages

* Assumes a 2-hour meeting. Scale down planned meeting duration for shorter work products.
** Flight software and other highly complex code segments should proceed at about half this rate.

Roles of Participants

Moderator
Responsible for conducting inspection process and collecting inspection data. Plays key role in all stages of process except rework. Required to perform special duties during an inspection in addition to inspector's tasks.

Inspectors
Responsible for finding defects in work product from a general point of view, as well as defects that affect their area of expertise.

Author
Provides information about work product during all stages of process. Responsible for correcting all major defects and any minor and trivial defects that cost and schedule permit. Performs duties of an inspector.

Reader
Guides team through work product during inspection meeting. Reads or paraphrases work product in detail. Should be an inspector from same (or next) life-cycle phase as author. Performs duties of an inspector in addition to reader's role.

Recorder
Accurately records each defect found during inspection meeting on the Inspection Defect List. Performs duties of an inspector in addition to recorder's role.

Based on JCK/LLW/SSP/HS: 10/92

Figure N-2 Peer reviews/inspections quick reference guide