WHERE FOUND		DEFECT ORIGIN								
		Requirement	**Analysis**	**Design**	**Coding**	**Unit Testing**	**Integration Testing**	**System Testing**	**Field**	**Total**
	Requirement	88								**88**
	Analysis	110	55							**165**
	Design	67	59	99						**225**
	Coding	34	63	72	311					**480**
	Unit Testing	44	44	55	121	10				**274**
	Integration Testing	34	9	32	38	-	11			**124**
	System Testing	6	5	5	23	-	-	9		**48**
	Field	7	2	4	12	-	-	-	3	**28**
	Total	**390**	**237**	**267**	**505**	**10**	**11**	**9**	**3**	**1432**

1. Defect removal rate for every phase:

Product size = 90KLOC

Therefore, **Defect removal rate= Defects removed/90KLOC**

Phase	Defects Detected	Defect Removal Rate
Requirement	88	0.977 defects/KLOC
Analysis	165	1.833 defects/KLOC
Design	225	2.5 defects/KLOC
Coding	480	5.333 defects/KLOC
Unit Testing	274	3.044 defects/KLOC
Integration Testing	124	1.377 defects/KLOC
System Testing	48	0.533 defects/KLOC
Field	28	0.311 defects/KLOC

2. Defect Injection Rate for every phase:

Product size = 90KLOC

Therefore, **Defect injection rate= Defects injected/90KLOC**

Phase	Defects Injected	Defect Removal Rate
Requirement	390	4.333 defects/KLOC
Analysis	237	2.633 defects/KLOC
Design	267	2.966 defects/KLOC
Coding	505	5.611 defects/KLOC
Unit Testing	10	0.111 defects/KLOC
Integration Testing	11	0.122 defects/KLOC
System Testing	9	0.1 defects/KLOC
Field	3	0.33 defects/KLOC

3. Defect escape rate for every phase:

Product size = 90KLOC

Therefore, Defect escape rate= Defects escaped/90KLOC

Phase	Defects Injected	Defects Detected	Defects Escaped	Defect Escape Rate
Requirement	390	88	390-88 = **302**	3.355 defects/KLOC
Analysis	237	165	390+237-88-165 = **374**	4.155 defects/KLOC
Design	267	225	390+237+267-88-165-225 = **416**	4.622 defects/KLOC
Coding	505	480	390+237+267+505-88-165-225-480 = **441**	4.9 defects/KLOC
Unit Testing	10	274	390+237+267+505+10-88-165-225-480-274 = **177**	1.96 defects/KLOC
Integration Testing	11	124	390+237+267+505+10+11-88-165-225-480-274-124 = **64**	0.711 defects/KLOC
System Testing	9	48	390+237+267+505+10+11+9-88-165-225-480-274-124-48 = **25**	0.277 defects/KLOC
Field	3	28	390+237+267+505+10+11+9+3-88-165-225-480-274-124-48-28 =	0 defects/KLOC

			0	

4. The most effective phase in removing defects:

Defect Removal Effectiveness in Development phases:

*Defect Removal Effectiveness for each development step = [Defects removed/Defect existing on step entry+ Defects injected during development] * 100%*

DRE in Requirement phase:
Defects removed in current phase = 88
Defects existing on step entry (escaped from previous phase) = 0
Defects injected in current phase = 390
Therefore, DRE = [88/ (0 + 390)] *100% = 22.56%

DRE in Analysis phase:
Defects removed in current phase = 165
Defects existing on step entry (escaped from previous phase) = 302
Defects injected in current phase = 237
Therefore, DRE = [165/ (302+237)] *100% = 30.61%

DRE in Design phase:
Defects removed in current phase = 225
Defects existing on step entry (escaped from previous phase) = 374
Defects injected in current phase = 267
Therefore, DRE = [225/ (374+267)] *100% = 35.10%

DRE in Coding phase:
Defects removed in current phase = 480
Defects existing on step entry (escaped from previous phase) = 416
Defects injected in current phase = 505
Therefore, DRE = [480/ (416+505)] *100% = 52.11%

DRE in Unit Testing phase:
Defects removed in current phase = 274
Therefore, DRE = [274/ (274+124+48+28)] *100% = 57.80%

Defect Removal Effectiveness in Testing phases:

*[Defects removed at current phase/ Defects removed at current phase + Defects removed at subsequent phases] * 100%*

DRE in Integration Testing phase:
Defects removed in current phase = 124

Therefore, DRE = [124/ (124 + 48+28)] *100 = 62%

<u>DRE in System Testing phase:</u>
Defects removed in current phase = 48
Therefore, DRE = [48/ (48+28)] *100 = 63.15%

<u>DRE in Field:</u>
Defects removed in current phase = 28
Therefore, DRE = [28/28] *100 = 100%

Consolidated table for Defect Removal Effectiveness:

Phase	**Defect Removal Effectiveness**
Requirement	**22.56%**
Analysis	**30.61%**
Design	**35.10%**
Coding	**52.11%**
Unit Testing	**57.80%**
Integration Testing	**62%**
System Testing	**63.15%**

From the above table we can see that System Testing phase has a DRE of 63.15 % which is higher compared to DRE in other phases**. Hence, System Testing phase is the most effective in removing defects.**

5. Overall defect removal effectiveness:

Overall DRE of the project = [1- (Defects removed in Field/Total number of Defects)] *100%
Therefore,
Overall DRE = [1- (28/1432)] *100% = 98.04%

6. **Yes, reviews and inspections were effective in removing the defects.** We can corroborate this using following data.
Total number of defects in the project = 1432
Number of defects caught through inspections and reviews = 958 (88+165+225+480)
Therefore, percentage of defects caught through inspections and reviews is 66.89% which proves the effectiveness of reviews and inspections.

7. Number of defects originated in Requirement phase = 390

If this number increases by 25%, then number of defects originated would be [(25/100) *390] + 390 = 487.5 approximately equal to 488.

Number of defects detected in Requirement phase = 88
If this number increases by 25%, then number of defects detected would be [(25/100) *88] + 88 = 110

Difference between the original number of defects injected and detected would be 390 – 88 = 302
And after raising the numbers by 25%, the difference would be 488-110 = 378

Which means 76 additional defects. These additional defects will be carried down to subsequent phases during which they might or might not be caught. If the defects go unnoticed then there is a good chance of increase in the number of errors in the subsequent phases, especially coding. **Hence it will have a negative impact on the defects originated in the coding phase.**

8. Number of defects originated in design phase = 267
If we increase this number by 5%, then the number of defects originated will be [(5/100) *267] + 267 = 280 approximately.
Number of defects detected in coding phase = 480
If we increase this number by 95%, then the number of defects detected would be 936.

However, this change will have not have any impact on defect removal effectiveness of the testing phases. This conclusion can be strengthened by Dunn's formula:

*Defect Removal Effectiveness for Testing phases= [Defects removed (current step)/ Defects removed at current phase+ Defects removed at subsequent phase] *100%*

Considering the above formula to calculate the defect removal effectiveness for testing phases, it can be noticed that only defects removed at the subsequent changes can affect the defect removal effectiveness for testing phases. Hence any number of defects originated in the design phase or detected during the coding phase will not have any impact. **Hence, there will be no impact.**