

	Fix pattern	Calculated clusters	Manual clusters	Expanded TBar FP	
1	Insert a null pointer checker with return null Insert: (IF, PARENTHESIZED, OPERATOR, IDENTIFIER, NULL_LITERAL, RETURN, NULL_LITERAL)	<u>jso-22</u> _{1..3}	jaD-13 _{1,2} , jso-22 _{1..3} , mat-4 _{1,2}	Insert Null Pointer Checker FP2.6: + if (exp == null) return null;	
2 3	Insert variable initialisation Insert: (IDENTIFIER, IDENTIFIER, EXPRESSION_STATEMENT, ASSIGNMENT)	<u>com-29</u> _{1..6} , jaC-26 , jso-85	jaC-26 com-29 _{1..6} , jso-85	Insert Assignment FP4.5: + var1 = var2	Insert Field Init. FP4.6: + obj.field = var
4	Insert Declaration with Initialisation Insert: (PRIMITIVE_TYPE, LITERAL, VARIABLE)	- clo-144 ₃ , clo-165 ₆ , <u>com-3</u> -	clo-26, clo-144 ₃ , clo-165 ₆ , com-3 , -	Insert Declaration with Initialisation FP4.7: + T var = literal	
	Insert Declaration with Initialisation Insert: (PRIMITIVE_TYPE, LITERAL, VARIABLE)	jaD-109 jaC-18 , jso-67 , <u>lan-23</u>	- jaC-18 , jso-31, jso-67 , lan-23		
5	Insert Declaration Insert: (IDENTIFIER, VARIABLE)	cli-22 ₄ , clo-16 ₃ , clo-163 _{29..31} , <u>com-29</u> _{7,8} , csv-16 ₂ , jso-87 ₁₄ , jxP-13 ₆	cli-22 ₄ , clo-16 ₃ , clo-163 _{29..31} , com-29 ₇ , csv-16 ₂ -	Insert Declaration without Init. FP4.8: + T var	
6	Insert Case Insert: (CASE, IDENTIFIER)	clo-80 , <u>clo-103</u> , gso-11 _{1,2} , jaD-32	clo-80 , clo-103 , gso-11 ₁ , jaD-32	Insert Case FP4.9: + case exp	
7	Insert an assignment Insert: (VARIABLE, PRIMITIVE_TYPE, LITERAL)	<u>clo-30</u> ₂ , clo-148 ₄₁ , jso-35, jso-31	clo-148 ₄₁ -	Insert Initialisation FP4.10: - var + var = literal	
8	Replace null with a variable Change: (NULL_LITERAL) to (IDENTIFIER)	cli-34 ₂ , clo-144 ₂ , jaD-107 , <u>jaD-95</u> ₂	clo-144 ₂ , jaD-107 -	Mutate Literal FP9.3: - literal + var	
9	Replace a method invocation with a variable Change: (METHOD_INVOCATION, IDENTIFIER) to (IDENTIFIER)	cli-1 ₄ , clo-134 _{2,3} , com-34 , <u>jaC-12</u> ₃ , jaD-95 ₁	cli-1 ₄ , clo-134 ₂ , com-34 , jaC-12 ₃ , jaD-95 ₁	Mutate Method FP10.6: - method + var	
10	Replace a variable with a new instance Change: (IDENTIFIER) to (NEW_CLASS, IDENTIFIER, IDENTIFIER)	jaX-5, <u>moc-6</u> _{1..15} , moc-14 ₁	moc-6 _{1..15} , moc-14 ₁	Mutate Variable FP13.3: - var + new instance	
11	Insert a method invocation Insert: (METHOD_INVOCATION, IDENTIFIER)	cha-10 , clo-3 ₃ , clo-90, com-20 _{1..3} , jso-6 , jso-29 , jso-56 _{1,2} , jso-88, lan-4 ₂ , mat-26 , moc-10 ₅ , moc-23 ₃ , moc-4 _{1,2}	cha-10 , com-20 _{1..3} , jso-6 , jso-29 , mat-24, mat-26 , moc-4 _{1,2}	Mutate Variable FP13.4: - var + method(var, ...)	

Table 1: Fix patterns and centroids of the new clusters and proposed extension of the TBar fix pattern (FP) taxonomy.