

# A Study on the Quality improvement of Building Systems in Apartment Houses through the Analysis of the Causes of Equipment Flaws

Park, Chang Bong    Kwon, Young Chul    Rhee, Eon Ku

## Abstract

In general, an apartment house has the most various flaws among structures. To provide the method to reduce equipment flaw in apartment buildings, this study analyzed the state of defect occurrence and classified it into flaw of construction sort, types and causes of flaws based on architectural equipment flaw occurrence register. Then those flaws were also analyzed to find out their causes. Finally, this study suggested the precaution to prevent flaw occurrence, post repair and maintenance, and systematical improvement device to reduce repeatedly occurred equipment flaws in apartment buildings.

The result of this study indicates that the major flaw cause is careless construction, which takes up up to 54.6% followed by poor quality of equipment materials as much as 27.6%. Therefore, above all, the instruction as well as the supervision for careful and sincere construction is required for more perfect and flawless equipment in buildings.

Keywords : Architectural equipment, Equipment flaw, Flaw type

|    |   |  |                                      |                                      |                                      |                                      |                                      |                                      |                                      |                                      |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |  |
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| 1. | <p style="text-align: center;">共同住宅</p> <p>住宅</p> <p style="text-align: center;">建築物</p> <p>設備</p> <p style="text-align: center;">生活環境</p> <p>善</p> <p style="text-align: center;">點檢</p> <p>分野</p> <p style="text-align: center;">中心</p> | <p style="text-align: center;">“A”社</p> <p style="text-align: center;">2</p> | <p style="text-align: center;">2</p> | <p style="text-align: center;">3</p> | <p style="text-align: center;">4</p> | <p style="text-align: center;">5</p> | <p style="text-align: center;">6</p> | <p style="text-align: center;">7</p> | <p style="text-align: center;">8</p> | <p style="text-align: center;">9</p> | <p style="text-align: center;">10</p> | <p style="text-align: center;">11</p> | <p style="text-align: center;">12</p> | <p style="text-align: center;">13</p> | <p style="text-align: center;">14</p> | <p style="text-align: center;">15</p> | <p style="text-align: center;">16</p> | <p style="text-align: center;">17</p> | <p style="text-align: center;">18</p> | <p style="text-align: center;">19</p> | <p style="text-align: center;">20</p> | <p style="text-align: center;">21</p> | <p style="text-align: center;">22</p> | <p style="text-align: center;">23</p> | <p style="text-align: center;">24</p> | <p style="text-align: center;">25</p> | <p style="text-align: center;">26</p> | <p style="text-align: center;">27</p> | <p style="text-align: center;">28</p> | <p style="text-align: center;">29</p> | <p style="text-align: center;">30</p> | <p style="text-align: center;">31</p> | <p style="text-align: center;">32</p> | <p style="text-align: center;">33</p> | <p style="text-align: center;">34</p> | <p style="text-align: center;">35</p> | <p style="text-align: center;">36</p> | <p style="text-align: center;">37</p> | <p style="text-align: center;">38</p> | <p style="text-align: center;">39</p> | <p style="text-align: center;">40</p> | <p style="text-align: center;">41</p> | <p style="text-align: center;">42</p> | <p style="text-align: center;">43</p> | <p style="text-align: center;">44</p> | <p style="text-align: center;">45</p> | <p style="text-align: center;">46</p> | <p style="text-align: center;">47</p> | <p style="text-align: center;">48</p> | <p style="text-align: center;">49</p> | <p style="text-align: center;">50</p> | <p style="text-align: center;">51</p> | <p style="text-align: center;">52</p> | <p style="text-align: center;">53</p> | <p style="text-align: center;">54</p> | <p style="text-align: center;">55</p> | <p style="text-align: center;">56</p> | <p style="text-align: center;">57</p> | <p style="text-align: center;">58</p> | <p style="text-align: center;">59</p> | <p style="text-align: center;">60</p> | <p style="text-align: center;">61</p> | <p style="text-align: center;">62</p> | <p style="text-align: center;">63</p> | <p style="text-align: center;">64</p> | <p style="text-align: center;">65</p> | <p style="text-align: center;">66</p> | <p style="text-align: center;">67</p> | <p style="text-align: center;">68</p> | <p style="text-align: center;">69</p> | <p style="text-align: center;">70</p> | <p style="text-align: center;">71</p> | <p style="text-align: center;">72</p> | <p style="text-align: center;">73</p> | <p style="text-align: center;">74</p> | <p style="text-align: center;">75</p> | <p style="text-align: center;">76</p> | <p style="text-align: center;">77</p> | <p style="text-align: center;">78</p> | <p style="text-align: center;">79</p> | <p style="text-align: center;">80</p> | <p style="text-align: center;">81</p> | <p style="text-align: center;">82</p> | <p style="text-align: center;">83</p> | <p style="text-align: center;">84</p> | <p style="text-align: center;">85</p> | <p style="text-align: center;">86</p> | <p style="text-align: center;">87</p> | <p style="text-align: center;">88</p> | <p style="text-align: center;">89</p> | <p style="text-align: center;">90</p> | <p style="text-align: center;">91</p> | <p style="text-align: center;">92</p> | <p style="text-align: center;">93</p> | <p style="text-align: center;">94</p> | <p style="text-align: center;">95</p> | <p style="text-align: center;">96</p> | <p style="text-align: center;">97</p> | <p style="text-align: center;">98</p> | <p style="text-align: center;">99</p> | <p style="text-align: center;">100</p> |
|----|---|--|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|--|

3 /分析  
 疵項目 發生 34,633 瑕疵  
 1 瑕疵

1. 瑕疵

|     |  |     |                |
|-----|--|-----|----------------|
|     |  |     |                |
| A 社 |  | 2 5 | 20<br>9,289    |
| B 社 |  | 1 3 | 26<br>15,364   |
| C 社 |  | 1   | 177<br>108,835 |

瑕疵 瑕疵 瑕疵 瑕疵  
 瑕疵 瑕疵 瑕疵  
 分類 分類 分類  
 分類

2.2 瑕疵發生 分析

(1) 分析

瑕疵 瑕疵  
 瑕疵 /

2. 瑕疵

|       |    |        |       |     |      |
|-------|----|--------|-------|-----|------|
|       |    |        | 瑕疵    | 瑕疵  | 瑕疵   |
| "A" 社 | 15 | 20,876 | 1,265 | 141 | 0.06 |
| "B" 社 | 26 | 75,483 | 7,763 | 863 | 0.11 |

3. 瑕疵

|    |       |      |      |      |
|----|-------|------|------|------|
|    |       | 1    | 2    | 3    |
| 瑕疵 | "A" 社 | 0.20 | 0.06 | 0.03 |
|    | "B" 社 | 0.14 | 0.07 | 0.02 |

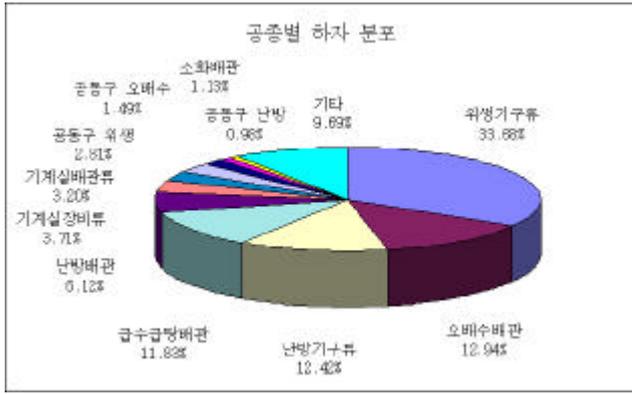
2 事項 瑕疵 (1 )  
 瑕疵 瑕疵

(2) 分析

分類 瑕疵  
 分析  
 4 瑕疵 瑕

4. 瑕疵

|     |                |                |                 |                 |    |
|-----|----------------|----------------|-----------------|-----------------|----|
|     | 瑕疵 (%)         |                |                 |                 |    |
|     | A              | B              | C               |                 |    |
| ( ) | 220 (4.31)     | 582 (7.50)     | 3,295(15.14)    | 4,097(11.83)    | 4  |
| ( ) | 652(12.76)     | 924(11.90)     | 2,907(13.36)    | 4,483(12.94)    | 2  |
| ( ) | 1,241(24.29)   | 4,557(58.70)   | 5,866(26.96)    | 11,664(33.68)   | 1  |
| ( ) | 401 (7.85)     | 621 (8.00)     | 1,097 (5.04)    | 2,119 (6.12)    | 5  |
| ( ) | 1,754(34.33)   | 722 (9.30)     | 1,825 (8.39)    | 4,301(12.42)    | 3  |
| ( ) | 44 (0.86)      | 23 (0.30)      | 1,217 (5.59)    | 1,284 (3.71)    | 6  |
| ( ) | 105 (2.06)     | 47 (0.61)      | 956 (4.39)      | 1,108 (3.20)    | 7  |
| ( ) | 224 (4.38)     | 116 (1.49)     | 634 (2.91)      | 974 (2.81)      | 8  |
| ( ) | 115 (2.25)     | 16 (0.20)      | 207 (0.95)      | 338 (0.98)      | 11 |
| ( ) | 184 (3.60)     | 54 (0.70)      | 278 (1.28)      | 516 (1.49)      | 9  |
|     | 81 (1.59)      | 23 (0.30)      | 288 (1.32)      | 392 (1.13)      | 10 |
|     | 88 (1.72)      | 78 (1.00)      | 3,191(14.67)    | 3,357 (9.69)    |    |
|     | 5,109 (100.00) | 7,763 (100.00) | 21,761 (100.00) | 34,633 (100.00) |    |



1. 瑕疵

瑕疵가 11,664 가 46.7%  
 ( ) 4,483 가 33.68%  
 12.94%가 16,147 가  
 , 瑕疵 가  
 ( ) 가

瑕疵

가 가

6

5. ( ) 瑕疵

|      | (%)         |             |               |               |
|------|-------------|-------------|---------------|---------------|
|      | A           | B           | C             |               |
|      | 18 (8.2)    | 36 (6.1)    | 477(14.5)     | 531(13.0)     |
|      | 10 (4.5)    | 48 (8.3)    | 243 (7.4)     | 301 (7.3)     |
|      | 62(28.2)    | 149(25.6)   | 972(29.5)     | 1,183(28.9)   |
|      | 2 (0.9)     | 2 (0.3)     | 363(11.0)     | 367 (9.0)     |
|      | 2 (0.9)     | 3 (0.6)     | 17 (0.5)      | 22 (0.5)      |
|      | 35(15.9)    | 14 (2.4)    | 151 (4.6)     | 200 (4.9)     |
| pipe | 68(30.9)    | 317(54.4)   | 724(22.0)     | 1,109(27.1)   |
| sink | 3 (1.4)     | 3 (0.6)     | 123 (3.7)     | 129 (3.1)     |
|      | 2 (0.9)     | 4 (0.7)     | 48 (1.4)      | 54 (1.3)      |
|      | 18 (8.2)    | 6 (1.0)     | 177 (5.4)     | 201 (4.9)     |
|      | 220 (100.0) | 582 (100.0) | 3,295 (100.0) | 4,097 (100.0) |

5

, 27.1%, 7.3%, 4.9%  
 28.9%, 13.0%, 9.0%,  
 瑕疵 가

A, B 社 瑕疵 가 30.9%, 54.4% 가  
 C 社 瑕疵 가 29.5%  
 瑕疵 22.0%

6. ( ) 瑕疵

|       | (%)         |             |               |               |
|-------|-------------|-------------|---------------|---------------|
|       | A           | B           | C             |               |
|       | 164(25.2)   | 506(54.8)   | 985(33.9)     | 1,655(36.9)   |
|       | 66(10.1)    | 36 (3.9)    | 114 (3.9)     | 216 (4.8)     |
|       | 101(15.5)   | 110(11.9)   | 140 (4.8)     | 351 (7.8)     |
|       | 16 (2.5)    | 34 (3.7)    | 119 (4.1)     | 169 (3.8)     |
| 가 ( ) | 91(13.9)    | 71 (7.7)    | 203 (7.0)     | 365 (8.1)     |
| 가 ( ) | 57 (8.7)    | 27 (2.9)    | 133 (4.6)     | 217 (4.8)     |
| 가     | 24 (3.7)    | 41 (4.4)    | 126 (4.3)     | 191 (4.3)     |
|       | 14 (2.1)    | 60 (6.5)    | 414(14.2)     | 488(10.9)     |
|       | 34 (5.2)    | 7 (0.8)     | 102 (3.5)     | 143 (3.2)     |
|       | 16 (2.5)    | 24 (2.6)    | 89 (3.1)      | 129 (2.9)     |
|       | 37 (5.7)    | 3 (0.3)     | 102 (3.5)     | 142 (3.2)     |
| 가     | 32 (4.9)    | 5 (0.5)     | 53 (1.8)      | 90 (2.0)      |
|       |             |             | 327(11.3)     | 327 (7.3)     |
|       | 652 (100.0) | 924 (100.0) | 2,907 (100.0) | 4,483 (100.0) |

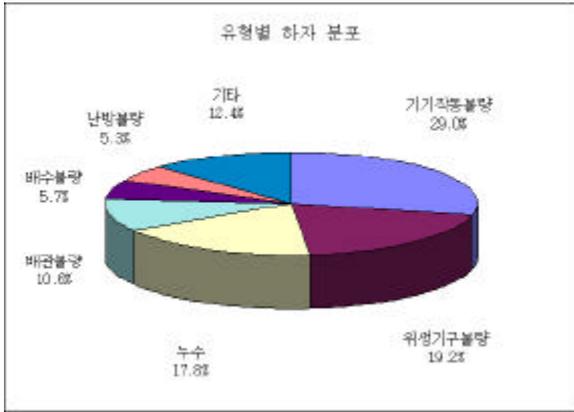
36.9%, 10.9%,  
 가 ( ) 8.1%, 7.8%,  
 4.8%, 가 ( ) 4.8%  
 瑕疵 가

(3) 分析

設備 瑕疵 配管 , , 排水 ,  
 , ,  
 瑕疵 7 2

7. 瑕疵

|  | (%)           |               |                |                |
|--|---------------|---------------|----------------|----------------|
|  | A             | B             | C              |                |
|  | 558(10.9)     | 1,676(21.6)   | 1,442 (6.6)    | 3,676(10.6)    |
|  | 932(18.2)     | 1,199(15.4)   | 4,025(18.5)    | 6,156(17.8)    |
|  | 402 (7.9)     | 325 (4.2)     | 1,242 (5.7)    | 1,969 (5.7)    |
|  | 1,847(36.1)   | 1,186(15.3)   | 7,024(32.3)    | 10,057(29.0)   |
|  | 243 (4.8)     | 326 (4.2)     | 1,252 (5.8)    | 1,821 (5.3)    |
|  | 741(14.5)     | 2,246(28.9)   | 3,675(16.9)    | 6,662(19.2)    |
|  | 386 (7.6)     | 805(10.4)     | 3,101(14.2)    | 4,292(12.4)    |
|  | 5,109 (100.0) | 7,763 (100.0) | 21,761 (100.0) | 34,633 (100.0) |



2. 瑕疵

分類

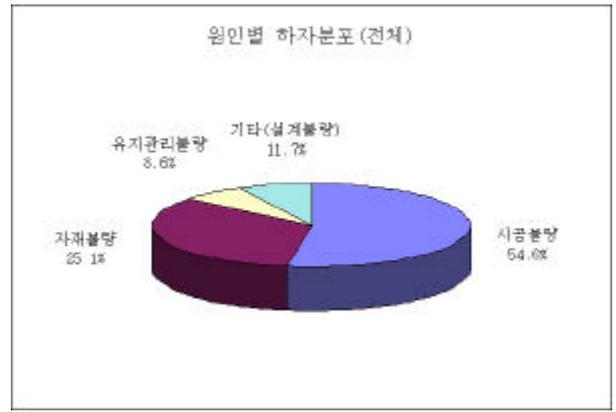
瑕疵 가 , 瑕疵가 10,057 29.0%  
 가 , 6,662 19.2%,  
 瑕疵 6,156 17.8%, 3,676 10.6%,  
 1,969 5.7%, 1,821 5.3% 가  
 .  
 瑕疵 10,057 .  
 2,752 27.4%, .  
 1,724 17.1%, .  
 1,522 15.1%, . 537 5.3%,

(4) 分析  
 設備 瑕疵 施工 , 資材 , 維持管理 ,  
 (設計 )  
 瑕疵 8 .

8. 瑕疵 ( )

|     | (%)              |                  |                   |                   |
|-----|------------------|------------------|-------------------|-------------------|
|     | A                | B                | C                 |                   |
|     | 2,689<br>(52.6)  | 5,263<br>(67.8)  | 10,949<br>(50.3)  | 18,901<br>(54.6)  |
|     | 1,408<br>(27.6)  | 1,917<br>(24.7)  | 5,369<br>(24.7)   | 8,694<br>(25.1)   |
|     | 331<br>(6.5)     | 298<br>(3.8)     | 2,344<br>(10.8)   | 2,973<br>(8.6)    |
| ( ) | 681<br>(13.3)    | 285<br>(3.7)     | 3,099<br>(14.2)   | 4,065<br>(11.7)   |
|     | 5,109<br>(100.0) | 7,763<br>(100.0) | 21,761<br>(100.0) | 34,633<br>(100.0) |

3



3. 瑕疵 ( )

分類

( ) 瑕疵  
 가 , 瑕疵  
 瑕疵 34,633 , 瑕疵가 18,901  
 瑕疵 54.6% , 8,694  
 25.1%, ( )가 4,065 11.7%,  
 2,973 8.6% .  
 79.7%

分析

資材

가

2.3 瑕疵

分析

瑕疵

分析

(1)

設備部分 瑕疵項目

瑕疵 分析

分類

項目

瑕疵

, , 7 項目

(가)

瑕疵

調査  
 가

瑕疵

足

施工不良  
 가

不

( )

漏水 瑕疵  
 17.8%

共同住宅

發生瑕疵

34,633  
 瑕疵

6,156

住宅

問題

瑕疵

1年

發生

가





2. 分類 瑕疵 33.68%  
 ( ) 12.94% 12.42%  
 ( , ) 11.83% ( ) 6.12%  
 ( ) 3.71% ( ) 3.20%  
 ( ) 2.81% ( )  
 ) 1.49% 1.13% ( )  
 0.98% 瑕疵 가

3. 29.0%, 19.2%, 17.8%,  
 10.6%, 5.7%, 5.3%, 12.4%  
 瑕疵 가

4. 54.6%, 25.1%, ( )  
 ) 11.7%, 8.6%  
 1. 瑕疵

2. 瑕疵 發生 事前  
 瑕疵發生 施工 維持管理가 瑕疵 工事  
 管理 合理化가 必要 , 瑕疵  
 가

1. 品質管理 改善 品質管理 品質感  
 謝制度 教育 方法 瑕疵 事前豫防  
 가 必要  
 2. 瑕疵 品質管理 資料  
 가 品質管理 品質管理 施工品質  
 品質管理 必要 ,  
 技術的 (E-Mail) 技術 가  
 標準化

| 研究  | 共同住宅 根本的   | 瑕疵原因 計劃 가                 | 補修方案 設計段階 檢討 | 缺陷 研究   |
|-----|--|---------------------------|--------------|---------|
| 1.  | “  | ”                         |              | 1989    |
| 2.  | “  | ”                         |              | , 1994. |
| 3.  | “  | ”                         |              | ”, 1986 |
| 4.  | “  | ”                         |              | ”,      |
| 5.  | 30 2   | ”, 1986                   |              |         |
| 6.  | ( )  | ”, 1998                   |              |         |
| 7.  | “  | ”                         |              | , 1996  |
| 8.  | “  | ”                         |              | , 1995  |
| 10. | “  | ”                         |              | , 1987  |
| 11. | “  | ”                         |              | , 1996  |
| 12. | “  | ”                         |              | , 1990  |
| 13. | “  | ”                         |              | , 1992  |
| 14. | “  | ”                         |              | , 1993  |
| 15. | “  | - TQC                     | -”           | , 1992  |
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