Assessment report of a R.C. retaining wall in Sulaymaniyah area/ Kurdistan Region.

1.Introduction

On September 8 2021 a site visit had been conducted to the site of an old built distressed retaining wall. The wall is reinforced concrete cantilever wall supporting a rigid paved road inside a functioning factory (Figure1& Figure2). This assessment aims to inspect the distress of referred structure and elaboration of the reasons and proposed solutions about the deterioration of the mentioned structure. Afterward, looking for, alterations that may reverse the wall condition positively. No destructive and non-destructive tests performed and the assessment totally relied on visual inspection and evaluation of attendants interviews. Worth to say, this structure does not have any project profile and history that may essentially enhance us in implementing our assessment properly, therefore, some assumptions adopted in this report for analyzing purpose.

2. Structure Description

The defected concrete wall is about 43.9m length and 0.3m thickness at the top and the height varies from 3.3m to 3.42m without clear information about the hidden parts of the wall due to lack of project file for previous works regarding of this structure. However, some precautions previously applied to this concrete wall, in order to maintain it and prevent it from collapse. But, it did not work adequately and couldn't stop the structure failure as we can see in (Figure3). The bolted steel plate, pulled up the crest of approached concrete wall and caused serious failure in the location that had been adhered to.

3. Assessment Result

Many defects, are founded in this structure due to lack of design and improper implementation of the structure with possibility of inadequate construction materials.

3.1 Mode of Failure

The modes of failure may be summarized in the following set and see (Figures 4,5,6,7,8,9,10);

1- Lack of design including:

a- Steel details
b- Dimensions
c- Concrete grade
d- Drainage distribution defect.
e- Lack of granular material behind of the wall.
2- Deterioration of concrete wall due to high water pressure behind the wall.
3- Cracks
4- Spalling

3.2 Result of Failure

Upper mentioned modes of failures lead to very serious defects and distress in the wall and may cause finally to prevent it from functioning adequately. Eventually, may lead to hazardous occasions to surrounded people. Mentioned above modes of failures are caused some kind of overturning failure aspect in the cantilever concrete wall, which essentially need to be solved as soon as possible. See (Figure11) for **Overturning failure**.

4. Recommendations

1- Because of the severe deterioration of mentioned above concrete. It may be better to remove it and demolish the existed concrete wall, and replace it with another reinforced concrete wall with adequate design and implementation under proper quality control.

2- Rehabilitation and repairment, can be applied successfully to the mentioned above defected concrete wall under good safety circumstances and precautions during the repairment process. It can be made according to the following procedure:

   A- Construction of a new reinforced concrete wall as support wall with a certain grade of at least C30 for sever environment. According to attached design with distance gap of 2m, through the length of the old concrete wall from down street side or in front of the defected wall with adherence to certain methods of implementations. Which will be instructed during the detailed design and construction process.

   B- Apply of certain I shape steel members in interval among the support wall three for each distance gap of 2m, so as to prevent the wall form deflection to outward and according to the design.

C- Apply of new drainage openings in the important spots with not more than 3m intervals, in order to drop down the water pressure behind and beneath the existed wall.

D- Repair of the serious cracks and defected spots with special construction materials.

E- Apply of three layers of plastic paint to the defected wall completely, in order to overcome the wetness from entering the cover part of concrete.

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

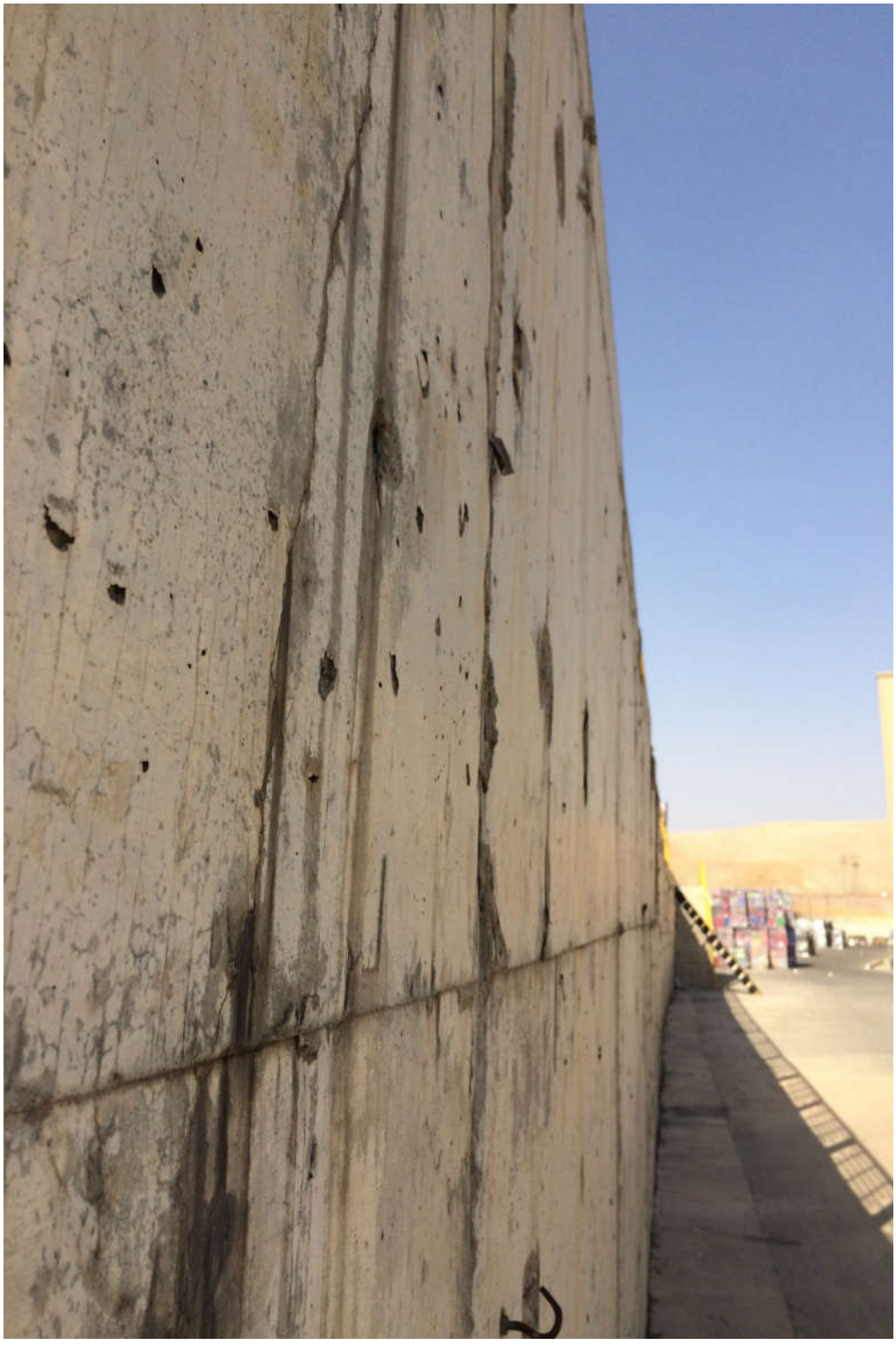


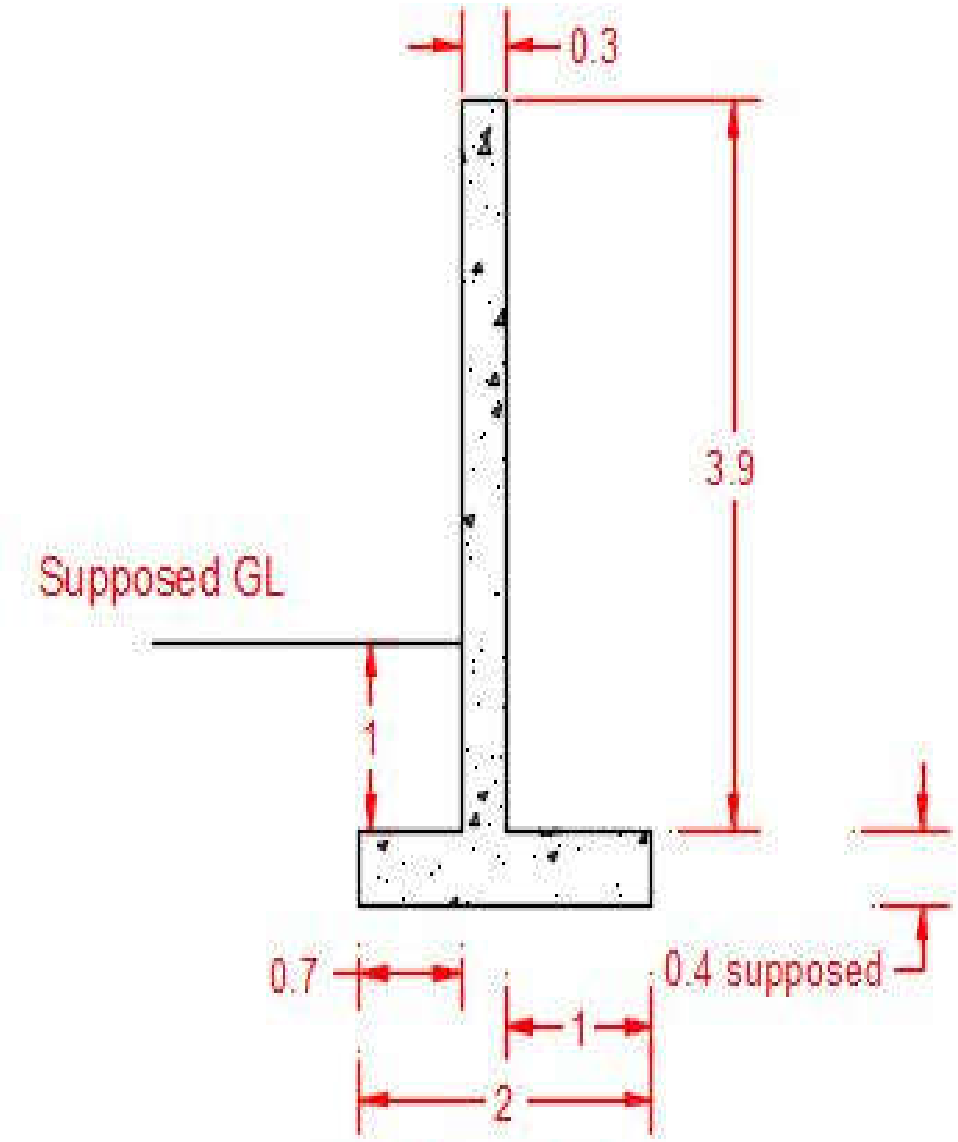
Figure 7

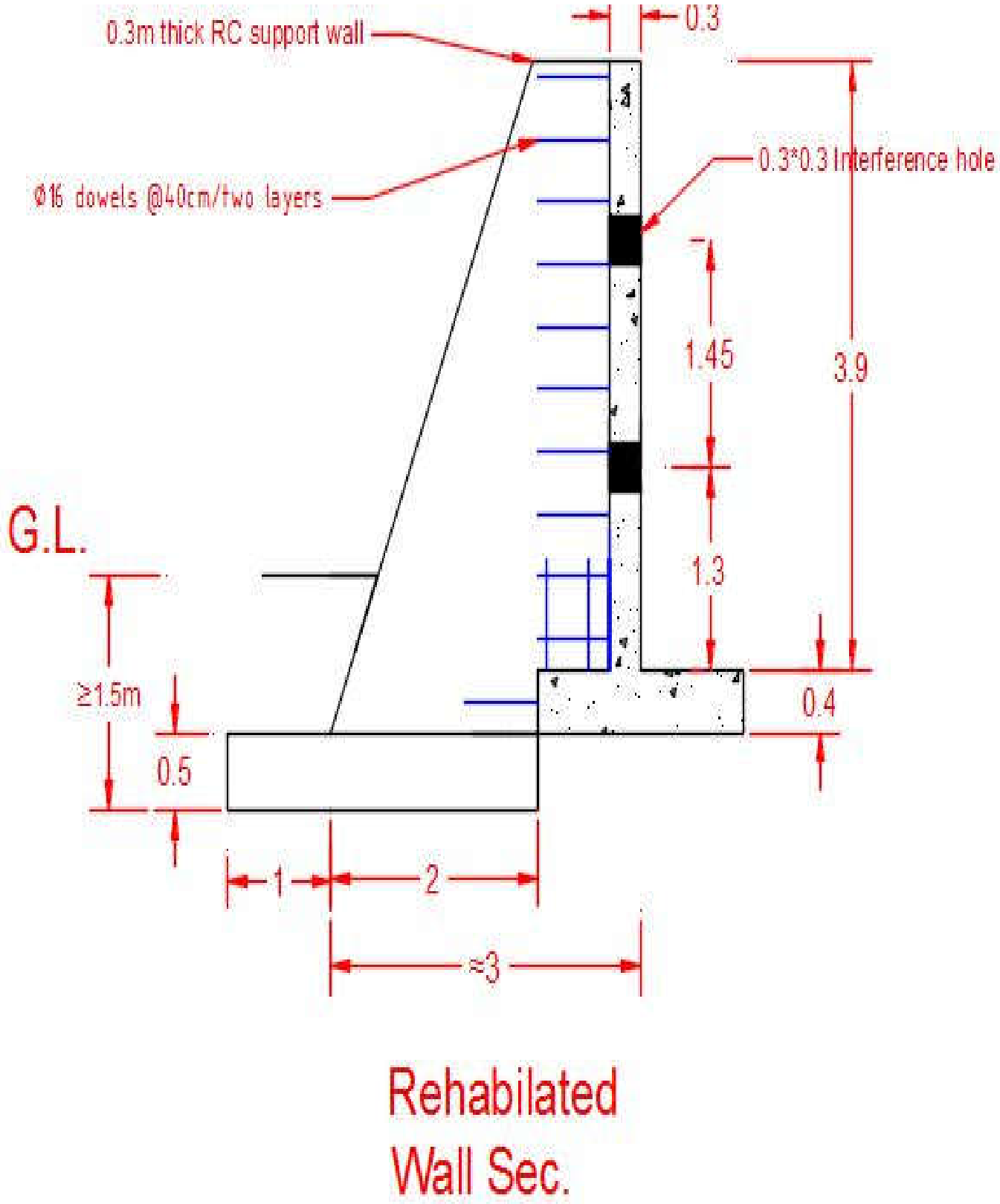
Figure 8

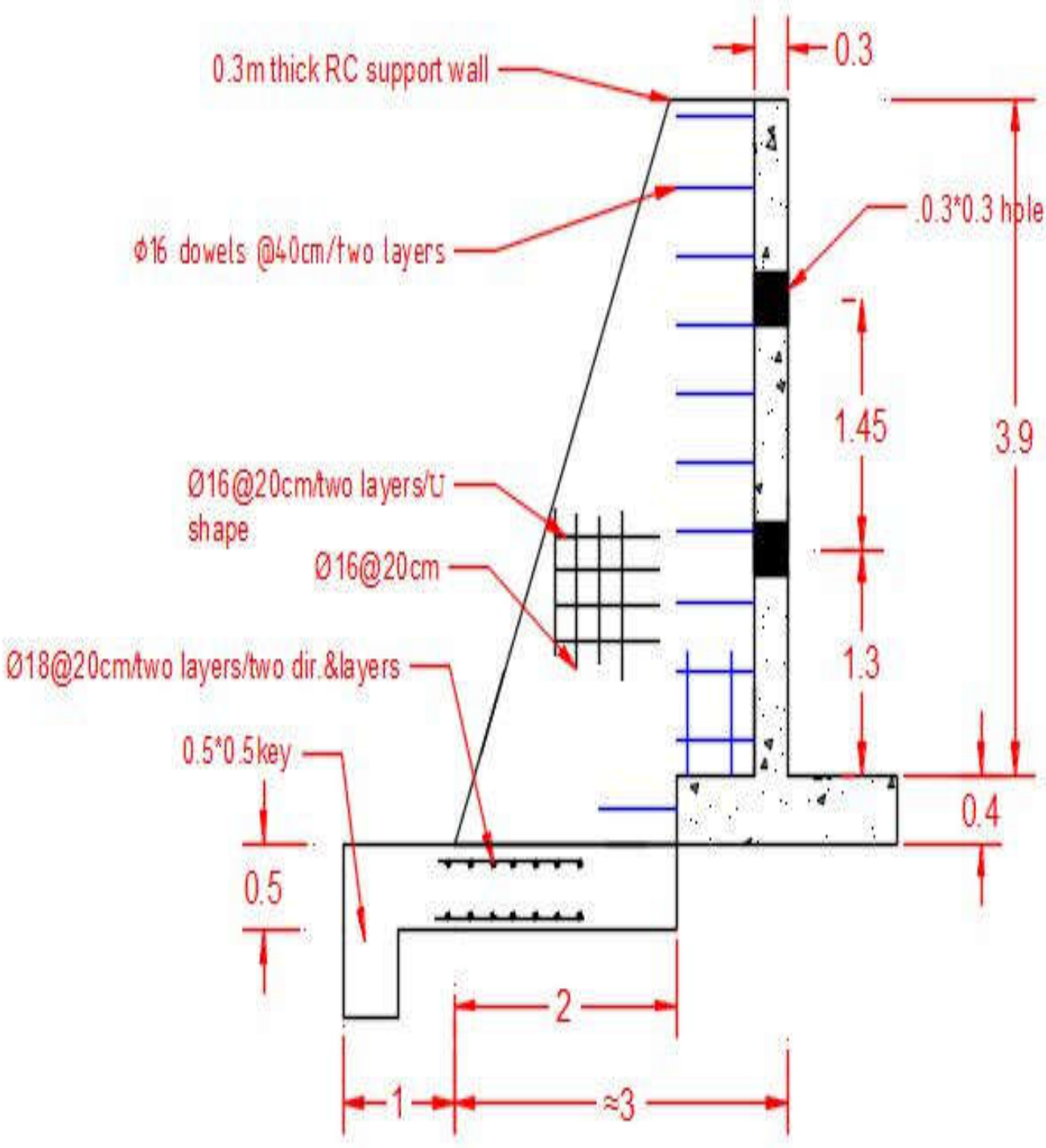
Figure 9

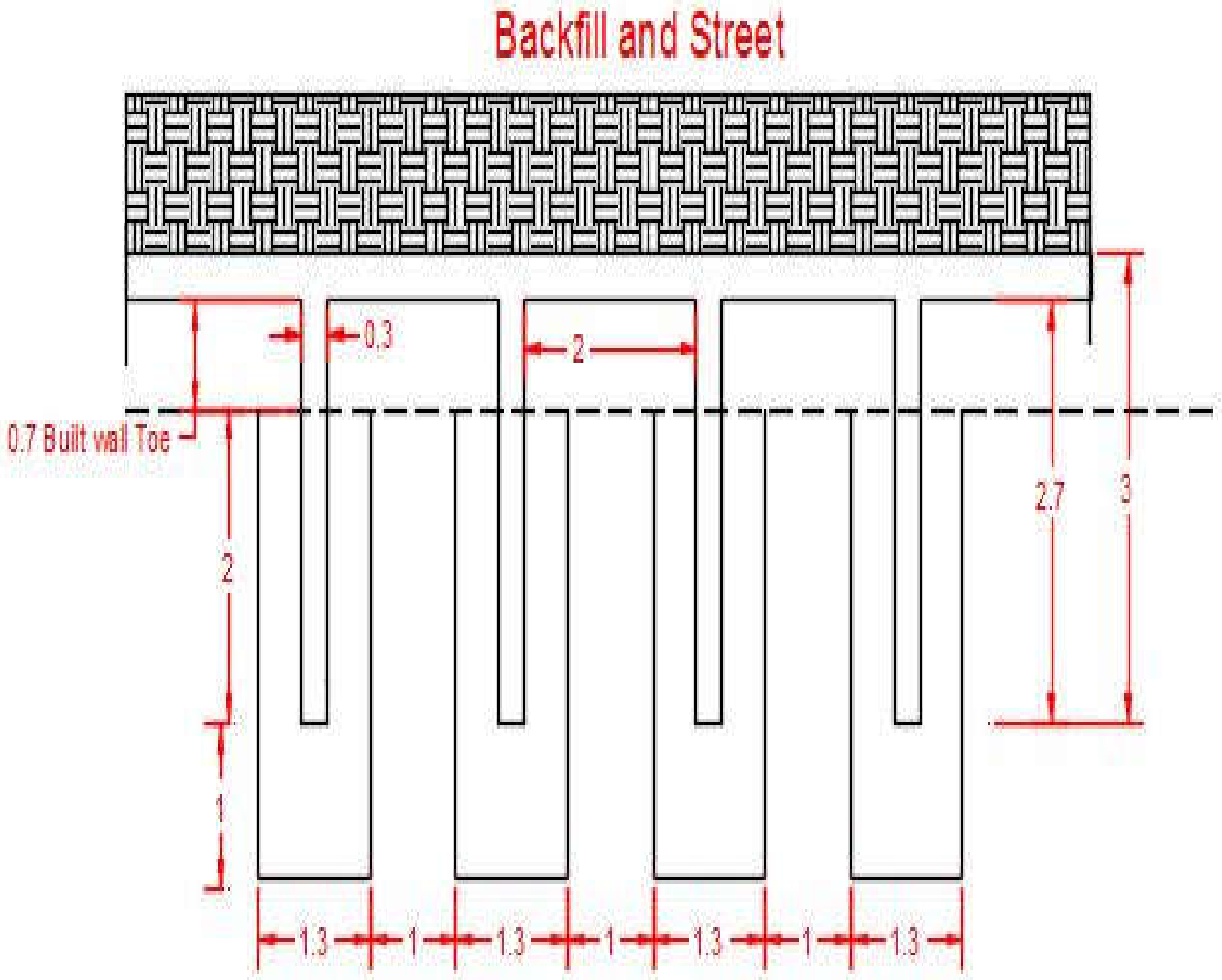
Figure 10

Figure 11


0.3
3.9
Supposed GL
1
0.7
0.4 supposed
1
2
Existed Wall
Sec. All Dim.
in M.


0.3m thick RC support wall
0.3
Ø16 dowels @40cm/two layers
0.3*0.3 Interference hole
1.45
3.9
G.L.
1.3
≥1.5m
0.4
0.5
1
2
≈3
Rehabilated
Wall Sec.


0.3m thick RC support wall
0.3
Ø16 dowels @40cm/two layers
.0.3*0.3 hole
1.45
3.9
Ø16@20cm/two layers/U shape
Ø16@20cm
Ø18@20cm/two layers/two dir.&layers
1.3
0.5*0.5key
0.4
0.5
2
1
≈3



Plan View of Rehabilitated wall

5. Design and Implémentation notes

A- Safety precautions essentially need to apply to all of work steps by supporting the defected concrete wall prior to carry out of any rehabilitation process. As well as, the safety tools for labors, in regard of the wall risk and environmental risk in this factory.

B- Prohibition of using of the upper street of that wall, for any heavy vehicle transportation during the project.

C- Better to use concrete cutter machine and small machines for excavation works, so as to minimize the wall risk.

D- Concrete grade should not be less than 30Mpa.
E- Using of sulfate resistance cement in concrete mix.
F- Steel grade is 420Mpa.
G- Concrete cover for the support wall 40mm and for the new foundation is 70mm.
H- Applying of 200 mm layer of bolder under a layer of nylon for foundation.
I- Drainage hole is 100mm Dia.
J- Using of hot rolled steel beam I-Section of 100mm.

K- Using of best western materials for repairment works of the cracks and painting items as well.
L- Using of special adhesive construction materials to tightly fix the dowels in the old wall.
M- Fair faced formworks, should be used for the work.
N- Any other instructions and consultations may encountered during the work can be arranged for afterward.