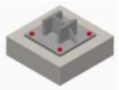
REF-A23

STEEL L ANGLE CONNECTION TO MASONRY FOR BRICK SUPPORT

PROJECT	Bangalore International Airport (BIAL) Terminal 2
LOCATION	Karnataka, India
CLIENT	Airport Authority of India
DESIGNER	L&T, EDRC
INSTALLATION	2022

Application	**L angle connection for brick support**
Design std.	**BS 8539, Annex B 2.3.2**
Hardware	**Hilti HRD-C, TE-2**
Software	**Manual calculations based on OST at jobsite**
Services	**On-site testing, meetings at designer's office**



LOAD/ CONDITIONS **Static**

CHALLENGES

- Non-approved ETA bricks at jobsite
- Understanding the evaluation criteria of anchors
- Finding out the relevant standard which can support the non-conformity of bricks not evaluated under any ETA

HILTI TOTAL SOLUTION

- ✓ Selection of pre-qualified and approved anchors for bricks
- ✓ On-site testing done as per BS 8539 standard
- ✓ Submitted design reports as per BS approval along with the ETA approval document

PROJECT HIGHLIGHT **Performing on-site testing of non-approved bricks based on BS guidelines**

APPLICATION AND REQUIREMENT

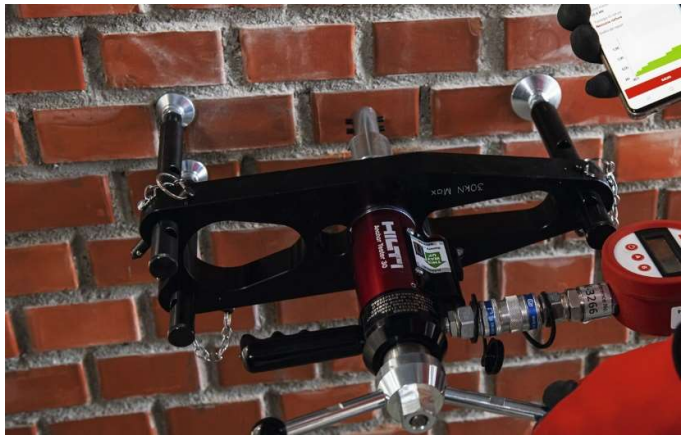
Application Details: Brick support connection

The masonry wall was constructed with the requirement of good aesthetic appearance. Designer wanted to have a solution where the shear force can be equally distributed among all the bricks. L angles were used for this purpose and connected to the solid brick / AAC masonry wall using post-installed anchors.

On-site testing arrangement

The selected anchors were not approved by any ETA for the bricks at jobsite. Hilti performed on-site analysis as per BS 8539 standard and submitted the evolution report along with the relevant ETA approval documents for the anchors.

APPROACH TOWARDS SOLUTION



On-site testing arrangement

The selected anchors were not approved by any ETA for the bricks at jobsite. Hilti performed on-site statistical analysis as per BS 8539 standard and submitted the evolution report along with the relevant ETA approval documents for the anchors. The approach by Hilti from initial stage helped to build reliability of the designer in terms of complying the criteria for checking the performance of anchors for the bricks at jobsite.

Post-installed anchors and other tools

- Post-installed bonded anchors- **HRD of size M10 x 100 mm** were used.
- Installation was done using Hilti drilling machine **TE-2**.

THE FINAL OUTCOME

The finished wall

Evaluation of on-site tests according to BS 8539 Annex B.2.3.2

Ultimate load tests ($n_{test} \geq 5$): Statistical evaluation (5%-fractile) of characteristic resistance With (or without) measurement of load at first movement

Anchor Type : HRD M10X100mm
Embedment 90mm
Borehole diameter :10mm
Bore Hole Depth :90mm
Base material: AAC block grade 3.8
Installation date (yyyy-mm-dd) - 2020-06-30
Number of anchors to test: 5

Ultimate load	
Test n	N_{Rec} [kN]
1	5.50
2	4.80
3	5.90
4	5.20
5	7.30 *The Higher capacity at the center of the block is omitted from the analysis at the out let

Maximal characteristic resistance	$N_{Rk,max}$ =	3.77	kN
Global safety factor for allowable resistance	γ =	2.00	[ ]
Ω_1-factor (base material)	Ω_1 =	1.00	[ ]
Ω_2-factor (application temperature)	Ω_2 =	1.00	[ ]
Ω_3-factor (rendered/plastered masonry)	Ω_3 =	1.00	[ ]
Ω_{tot}-factor = $\Omega_1 \cdot \Omega_2 \cdot \Omega_3$	Ω_{tot} =	1.00	[ ]
Measurement of load at first movement	NO		
Sum of all ultimate load values: ΣN_{Rec}	ΣN_{Rec} =	21.40	kN
Total number of tests: n	n =	4	[ ]
Mean value of the ultimate load: $N_{Rec,m}$	$N_{Rec,m}$ =	5.35	kN
k-factor (tolerance factor based on a confidence level of 90%)	k_{ucr} =	3.40	[ ]
Standard deviation: $s_{Rec} = (\Sigma_{i=1}^{n} (N_{Rec,i} - N_{Rec,m})^2 / (n-1))^{0.5}$	s_{Rec} =	0.47	kN
Coefficient of variation of the ultimate load: $v_{Rec} = s_{Rec} / N_{Rec,m} \leq 30\%$	v_{Rec} =	0.09	[ ]
Characteristic resistance: $N_{Rk,1} = N_{Rec,m} \cdot (1 - k \cdot v) \cdot \Omega \leq N_{Rk,max}$	$N_{Rk,1}$ =	3.77	kN
Characteristic resistance: $N_{Rk,1} = N_{Rec,m} \cdot (1 - k \cdot v) \cdot \Omega \leq N_{Rk,max}$	$N_{Rk,1} \leq N_{Rk,max}$ =	3.77	kN
Allowable resistance without measurement of displacement: $N_{Rk,all,1} = N_{Rk,1}/\gamma$	$N_{Rk,all,1}$ =	1.88	kN