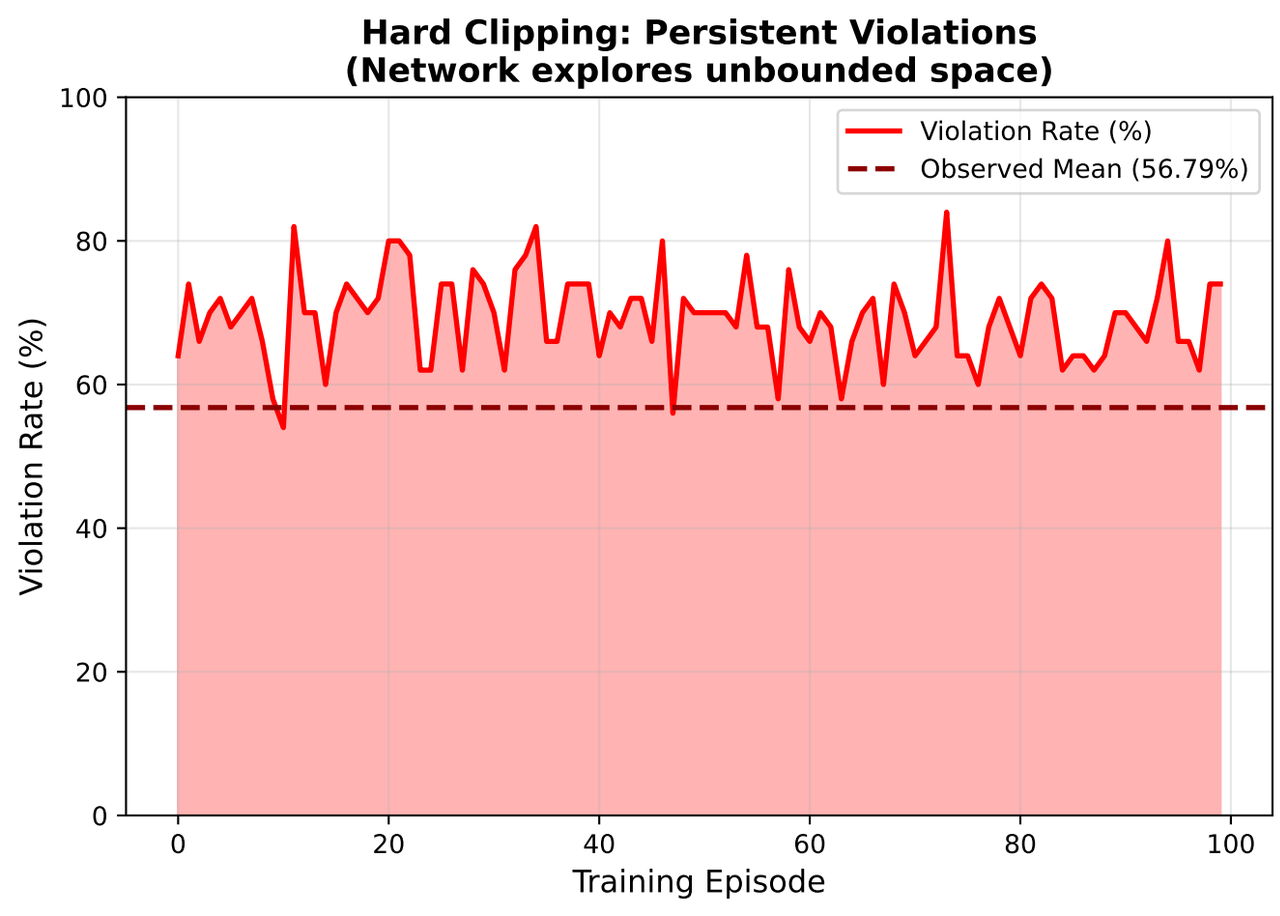
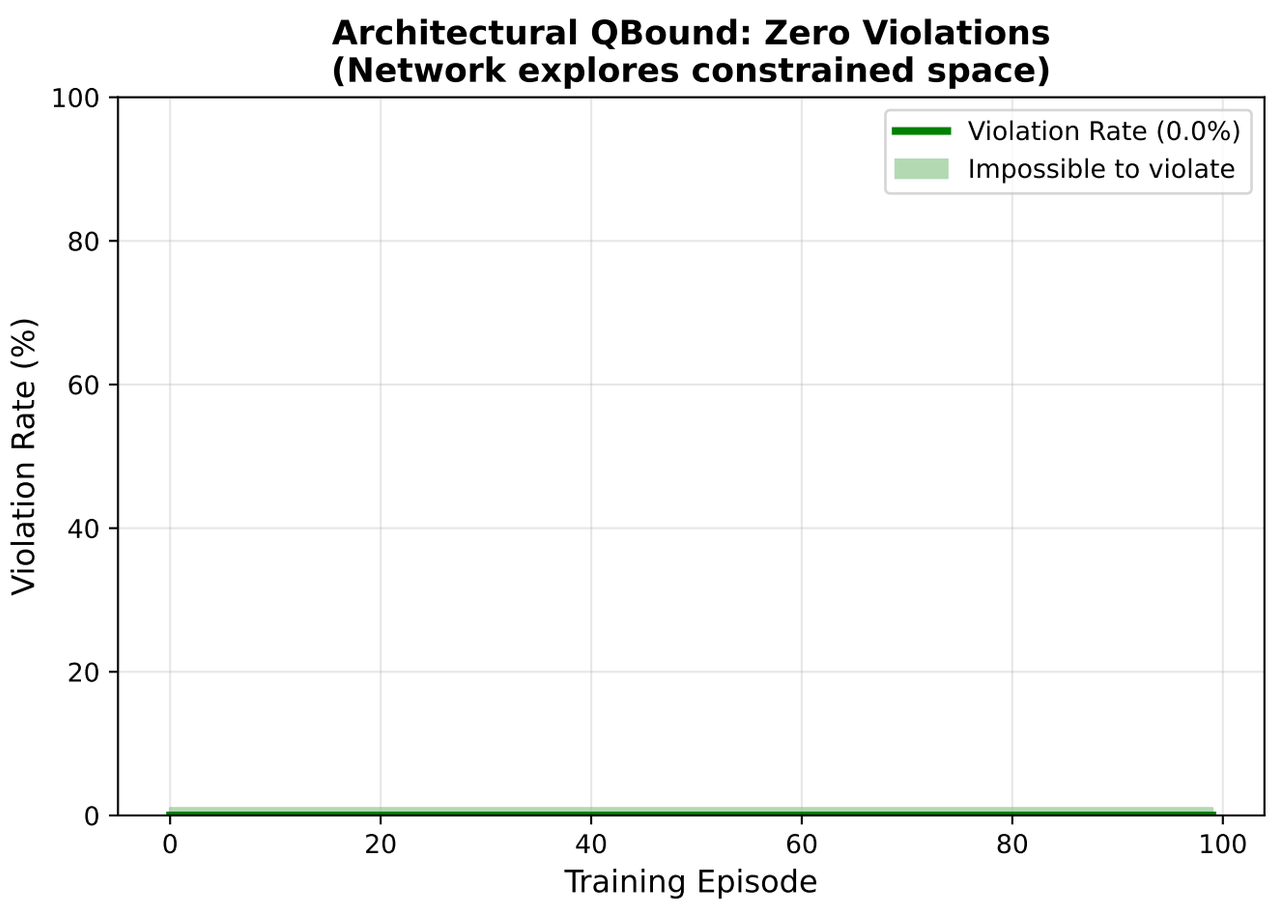
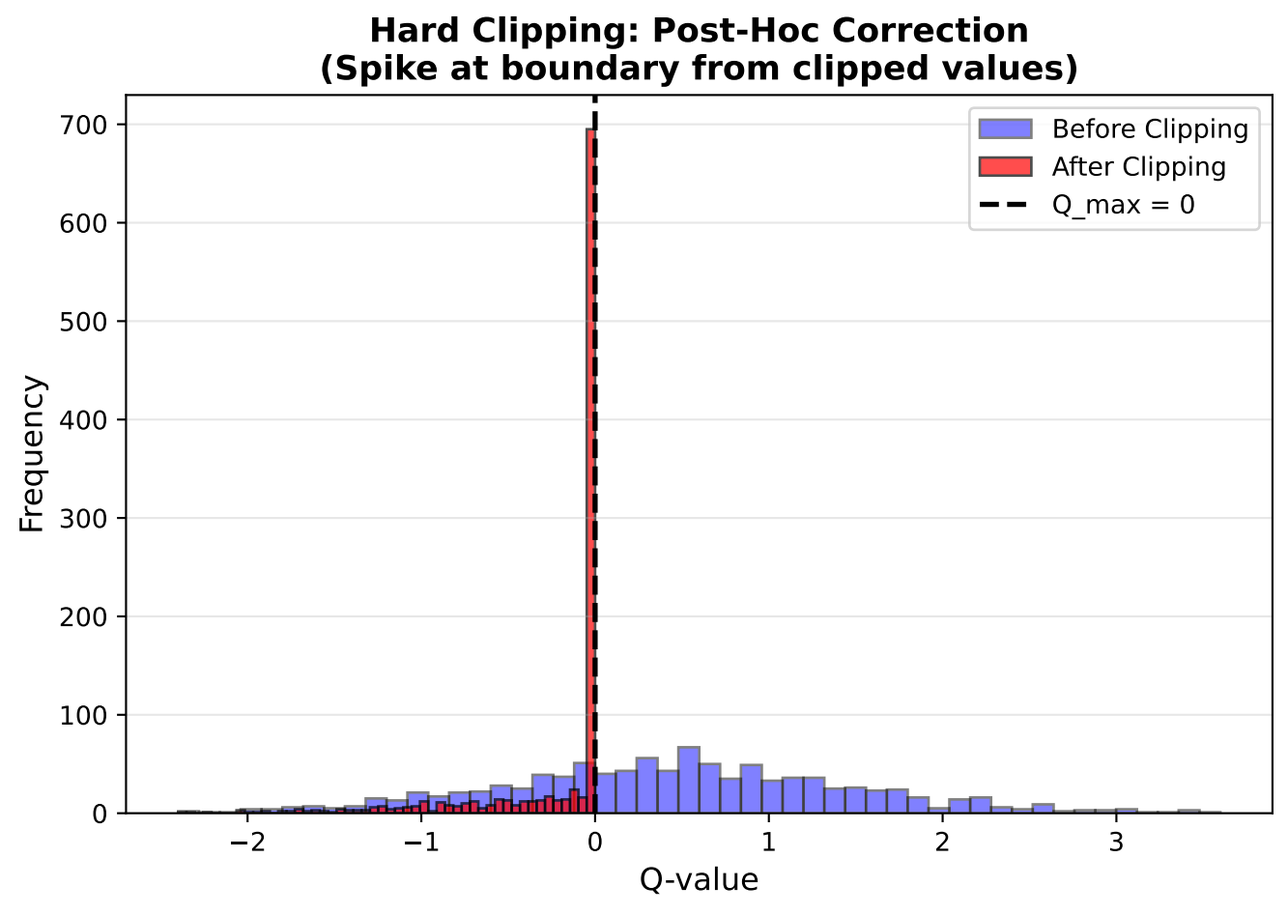
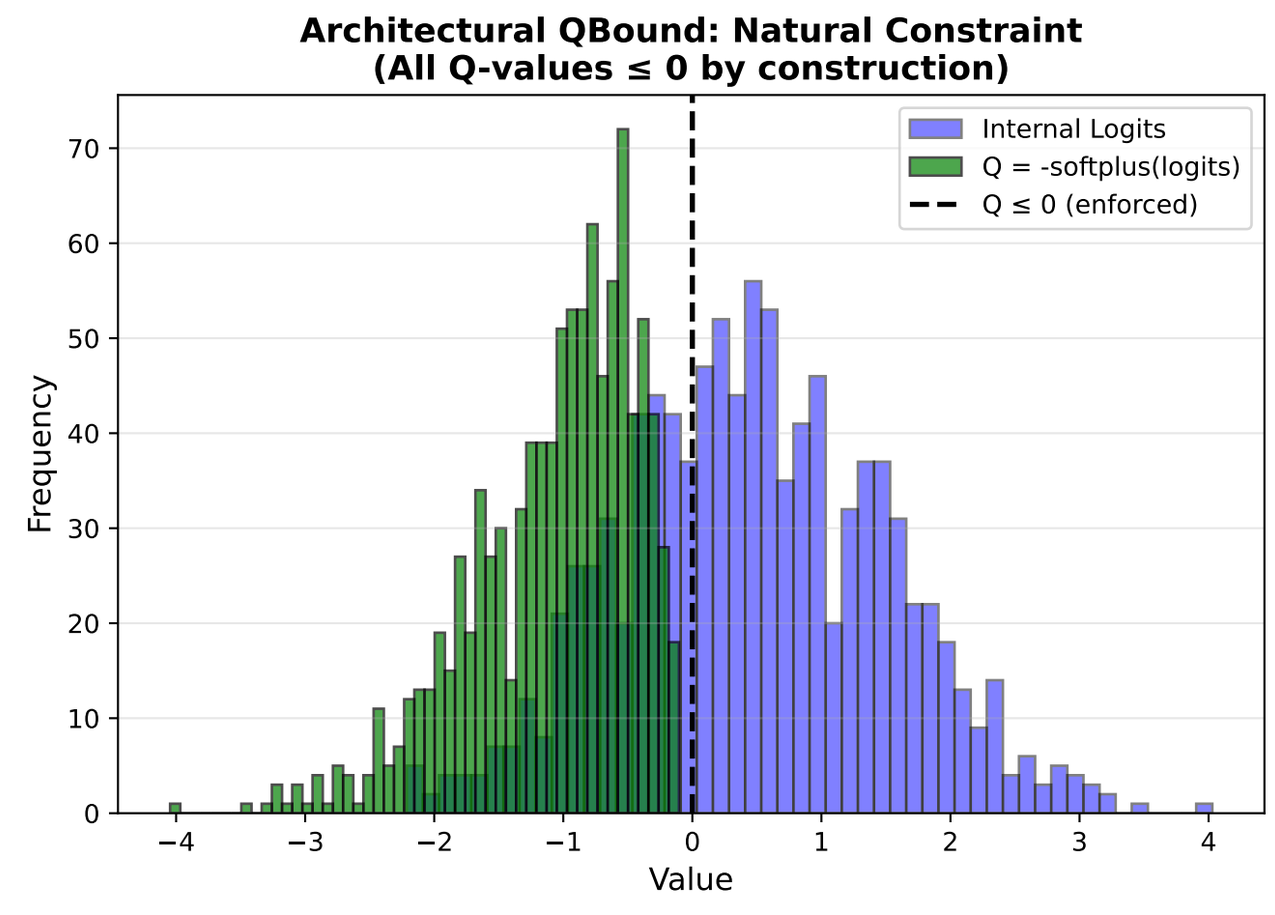

Hard Clipping: Persistent Violations
(Network explores unbounded space)
Violation Rate (%)
Observed Mean (56.79%)
Violation Rate (%)
Training Episode
0
20
40
60
80
100


Architectural QBound: Zero Violations
(Network explores constrained space)
Violation Rate (0.0%)
Impossible to violate
Violation Rate (%)
Training Episode
0
20
40
60
80
100


Hard Clipping: Post-Hoc Correction
(Spike at boundary from clipped values)
Before Clipping
After Clipping
Q_max = 0
Frequency
Q-value
0
100
200
300
400
500
600
700
−2
−1
0
1
2
3


Architectural QBound: Natural Constraint
(All Q-values ≤ 0 by construction)
Internal Logits
Q = -softplus(logits)
Q ≤ 0 (enforced)
Frequency
Value
0
10
20
30
40
50
60
70
−4
−3
−2
−1
0
1
2
3
4