

# Control Formula Demonstration (Refined v2)

## Formula Overview

### Step 1: Calculate Control Strength

Strength = Political Authority + Population Base + Demographic Bonuses

Components:

1. Political Authority: +25 points if won 1990 election
2. Population Base: Each % of population = 1 point
3. Demographic Bonuses:
  - Strong Majority: +15 if faction has >55% population
  - Plurality Lead: +5 if faction has plurality AND >10% lead over 2nd

### Step 2: Determine Control Status

SOLE CONTROL: Top  $\geq 60$  strength AND  $\geq 15$  lead over 2nd

WEAK CONTROL: Top  $\geq 45$  strength but doesn't meet sole control criteria

CONTESTED (2-way): Top 2 within 20 points AND 2nd  $\geq 25$

CONTESTED (3-way): Top 3 within 25 points AND all  $\geq 20$

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## Key Test Cases

### 1. GORNJI VAKUF-USKOPLJE ⚠ (The Problem Case)


**Election:** HDZ won | **Population:** Bosniak 55.8%, Croat 42.5%

#### Calculation:

- **RBiH:** 0 (no election) + 55.8 (pop) + 15 (>55% bonus) = **70.8**
- **HRHB:** 25 (election) + 42.5 (pop) + 0 = **67.5**
- **RS:** 0 + 0.4 + 0 = **0.4**

#### Analysis:

- Lead:  $70.8 - 67.5 = 3.3$  (within 20)
- RBiH  $\geq 60$  ✓, but lead only 3.3 (needs  $\geq 15$ ) ✗
- HRHB  $\geq 25$  ✓

**Result: CONTESTED (2-way) RBiH vs HRHB**  **Why:** Despite HDZ election win, Bosniak majority (>55%) gives them demographic strength. The close contest accurately reflects the tense situation.

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## 2. BUSOVAČA


**Election:** HDZ won | **Population:** Bosniak 44.8%, Croat 48.2%

**Calculation:**

- **HRHB:**  $25 \text{ (election)} + 48.2 \text{ (pop)} + 0 = \mathbf{73.2}$
- **RBiH:**  $0 + 44.8 + 0 = \mathbf{44.8}$
- **RS:**  $0 + 3.3 + 0 = \mathbf{3.3}$

**Analysis:**

- Lead:  $73.2 - 44.8 = 28.4 (>20)$
- HRHB  $\geq 60$  ✓ and lead  $\geq 15$  ✓

**Result: SOLE CONTROL HRHB**  **Why:** HDZ election + Croat plurality (even though slim) = clear control

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## 3. VITEZ

**Election:** HDZ won | **Population:** Bosniak 41.3%, Croat 45.5%

**Calculation:**

- **HRHB:**  $25 \text{ (election)} + 45.5 \text{ (pop)} + 0 = \mathbf{70.5}$
- **RBiH:**  $0 + 41.3 + 0 = \mathbf{41.3}$
- **RS:**  $0 + 5.4 + 0 = \mathbf{5.4}$

**Analysis:**

- Lead:  $70.5 - 41.3 = 29.2 (>20)$
- HRHB  $\geq 60$  ✓ and lead  $\geq 15$  ✓

**Result: SOLE CONTROL HRHB**  **Why:** Election win + clear Croat plurality

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#### 4. KISELJAK

**Election:** HDZ won | **Population:** Bosniak 40.5%, Croat 51.9%

**Calculation:**

- **HRHB:**  $25 \text{ (election)} + 51.9 \text{ (pop)} + 0 = \mathbf{76.9}$
- **RBiH:**  $0 + 40.5 + 0 = \mathbf{40.5}$
- **RS:**  $0 + 3.1 + 0 = \mathbf{3.1}$

**Analysis:**

- Lead:  $76.9 - 40.5 = 36.4 (>20)$
- $\text{HRHB} \geq 60 \checkmark$  and  $\text{lead} \geq 15 \checkmark$

**Result: SOLE CONTROL HRHB**  **Why:** Both election and demographic majority

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#### 5. KOTOR VAROŠ

**Election:** SDA won | **Population:** Serb 38.1%, Bosniak 30.1%, Croat 29.0%

**Calculation:**

- **RBiH:**  $25 \text{ (election)} + 30.1 \text{ (pop)} + 0 = \mathbf{55.1}$
- **RS:**  $0 + 38.1 + 0 = \mathbf{38.1}$
- **HRHB:**  $0 + 29.0 + 0 = \mathbf{29.0}$

**Analysis:**

- Lead:  $55.1 - 38.1 = 17.0 \text{ (within 20)}$
- Range:  $55.1 - 29.0 = 26.1 (>25, \text{ so not 3-way})$
- $\text{RBiH} \geq 45 \checkmark$ , lead 17.0 (needs  $\geq 15$  for sole control)

**Result: WEAK CONTROL RBiH**  **Why:** SDA won election but Serbs are plurality - politically controlled but demographically weak

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#### 6. MODRIČA

**Election:** SDA won | **Population:** Serb 44.4%, Croat 24.2%, Bosniak 22.7%

**Calculation:**

- **RBİH:**  $25 \text{ (election)} + 22.7 \text{ (pop)} + 0 = \mathbf{47.7}$
- **RS:**  $0 + 44.4 + 0 = \mathbf{44.4}$
- **HRHB:**  $0 + 24.2 + 0 = \mathbf{24.2}$

#### Analysis:

- Lead:  $47.7 - 44.4 = 3.3$  (within 20)
- Range:  $47.7 - 24.2 = 23.5$  (within 25)
- All  $\geq 20$  ✓

**Result: CONTESTED (3-way)** RBİH vs RS vs HRHB ✓ **Why:** Election winner has smallest ethnic group - all three factions have claims

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### 7. DOBOJ

**Election:** SDA won | **Population:** Serb 49.5%, Bosniak 30.7%, Croat 11.2%

#### Calculation:

- **RBİH:**  $25 \text{ (election)} + 30.7 \text{ (pop)} + 0 = \mathbf{55.7}$
- **RS:**  $0 + 49.5 + 0 = \mathbf{49.5}$
- **HRHB:**  $0 + 11.2 + 0 = \mathbf{11.2}$

#### Analysis:

- Lead:  $55.7 - 49.5 = 6.2$  (within 20)
- RS  $\geq 25$  ✓

**Result: CONTESTED (2-way)** RBİH vs RS ✓ **Why:** SDA won but Serbs have plurality - clear 2-way contest

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### 8. ILIJAS

**Election:** SDA won | **Population:** Serb 45.2%, Bosniak 41.7%, Croat 6.9%

#### Calculation:

- **RBİH:**  $25 \text{ (election)} + 41.7 \text{ (pop)} + 0 = \mathbf{66.7}$
- **RS:**  $0 + 45.2 + 0 = \mathbf{45.2}$
- **HRHB:**  $0 + 6.9 + 0 = \mathbf{6.9}$

### Analysis:

- Lead:  $66.7 - 45.2 = 21.5$  ( $>20$ , needs  $\leq 20$  for contested)
- RBiH  $\geq 60$  ✓ but lead  $21.5$  (needs  $\geq 15$  for sole control) ✓

**Result: SOLE CONTROL RBiH** ✓ **Why:** Election win + close to parity gives RBiH control, though unstable

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## 9. BANJA LUKA

**Election:** SDS won | **Population:** Serb 54.6%, Bosniak 14.6%, Croat 14.8%

### Calculation:

- **RS:**  $25$  (election) +  $54.6$  (pop) +  $0 = 79.6$
- **HRHB:**  $0 + 14.8 + 0 = 14.8$
- **RBiH:**  $0 + 14.6 + 0 = 14.6$

### Analysis:

- Lead:  $79.6 - 14.8 = 64.8$  (overwhelming)
- RS  $\geq 60$  ✓ and lead  $\geq 15$  ✓

**Result: SOLE CONTROL RS** ✓ **Why:** Clear demographic majority + election = dominant control

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## 10. JAJCE

**Election:** SDA won | **Population:** Bosniak 40.0%, Croat 35.9%, Serb 17.1%

### Calculation:

- **RBiH:**  $25$  (election) +  $40.0$  (pop) +  $0 = 65.0$
- **HRHB:**  $0 + 35.9 + 0 = 35.9$
- **RS:**  $0 + 17.1 + 0 = 17.1$

### Analysis:

- Lead:  $65.0 - 35.9 = 29.1$  ( $>20$ )
- RBiH  $\geq 60$  ✓ and lead  $\geq 15$  ✓

**Result: SOLE CONTROL RBiH** ✓ **Why:** Election + plurality gives clear control

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## 11. BRČKO


**Election:** SDA won | **Population:** Bosniak 44.1%, Croat 25.4%, Serb 20.7%

**Calculation:**

- **RBİH:**  $25 \text{ (election)} + 44.1 \text{ (pop)} + 5 \text{ (>10\% lead)} = \mathbf{74.1}$
- **HRHB:**  $0 + 25.4 + 0 = \mathbf{25.4}$
- **RS:**  $0 + 20.7 + 0 = \mathbf{20.7}$

**Analysis:**

- Lead:  $74.1 - 25.4 = 48.7 \text{ (>20)}$
- RBİH  $\geq 60$  ✓ and lead  $\geq 15$  ✓

**Result:** **SOLE CONTROL** RBİH  **Why:** Election + strong plurality + plurality bonus = solid control

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## 12. BROD

**Election:** HDZ won | **Population:** Croat 41.3%, Serb 33.0%, Bosniak 12.1%

**Calculation:**

- **HRHB:**  $25 \text{ (election)} + 41.3 \text{ (pop)} + 5 \text{ (>10\% lead)} = \mathbf{71.3}$
- **RS:**  $0 + 33.0 + 0 = \mathbf{33.0}$
- **RBİH:**  $0 + 12.1 + 0 = \mathbf{12.1}$

**Analysis:**

- Lead:  $71.3 - 33.0 = 38.3 \text{ (>20)}$
- HRHB  $\geq 60$  ✓ and lead  $\geq 15$  ✓

**Result:** **SOLE CONTROL** HRHB  **Why:** Election + plurality + plurality bonus

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## 13. BUGOJNO

**Election:** SDA won | **Population:** Bosniak 42.0%, Croat 34.2%, Serb 18.5%

**Calculation:**

- **RBiH:**  $25 \text{ (election)} + 42.0 \text{ (pop)} + 0 = \mathbf{67.0}$
- **HRHB:**  $0 + 34.2 + 0 = \mathbf{34.2}$
- **RS:**  $0 + 18.5 + 0 = \mathbf{18.5}$

**Analysis:**

- Lead:  $67.0 - 34.2 = 32.8 (>20)$
- RBiH  $\geq 60$  ✓ and lead  $\geq 15$  ✓

**Result: SOLE CONTROL RBiH** ✓ **Why:** Election + plurality despite significant Croat minority

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#### 14. NOVI TRAVNIK

**Election:** SDA won | **Population:** Croat 39.6%, Bosniak 37.9%, Serb 13.3%

**Calculation:**

- **RBiH:**  $25 \text{ (election)} + 37.9 \text{ (pop)} + 0 = \mathbf{62.9}$
- **HRHB:**  $0 + 39.6 + 0 = \mathbf{39.6}$
- **RS:**  $0 + 13.3 + 0 = \mathbf{13.3}$

**Analysis:**

- Lead:  $62.9 - 39.6 = 23.3 (>20)$
- RBiH  $\geq 60$  ✓ and lead  $\geq 15$  ✓

**Result: SOLE CONTROL RBiH** ✓ **Why:** Election win overcomes slight Croat plurality (very unstable)

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#### 15. VAREŠ

**Election:** HDZ won | **Population:** Croat 40.6%, Bosniak 30.2%, Serb 16.4%

**Calculation:**

- **HRHB:**  $25 \text{ (election)} + 40.6 \text{ (pop)} + 0 = \mathbf{65.6}$
- **RBiH:**  $0 + 30.2 + 0 = \mathbf{30.2}$
- **RS:**  $0 + 16.4 + 0 = \mathbf{16.4}$

**Analysis:**

- Lead:  $65.6 - 30.2 = 35.4$  ( $>20$ )
- HRHB  $\geq 60$  ✓ and lead  $\geq 15$  ✓

**Result: SOLE CONTROL HRHB** ✓ **Why:** Election + plurality = control

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## Summary Statistics

### Control Type Distribution:

- **SOLE CONTROL:** Clear dominance (60+ strength, 15+ lead)
- **WEAK CONTROL:** Leading but unstable (45+ strength, <15 lead)
- **CONTESTED (2-way):** Two factions competing
- **CONTESTED (3-way):** All three factions relevant

### Formula Strengths:

- ✓ Recognizes demographic majorities even against election results (Gornji Vakuf)
- ✓ Still gives elections significant weight (Novi Travnik)
- ✓ Creates 3-way contested areas where all groups relevant (Modriča)
- ✓ Identifies weak control situations (Kotor Varoš)
- ✓ Properly weights strong majorities with >55% bonus

### Key Insights:

- **Election Bonus (25 pts):** Strong but not overwhelming
- **>55% Majority Bonus (+15):** Recognizes clear demographic control
- **Plurality Lead Bonus (+5):** Rewards clear pluralities vs close splits
- **Thresholds:** Calibrated so ~60 is solid control, 45-60 is weak/contested