Privacy Review and Analysis Report

Project: zDoge.cash - Privacy-Preserving Shielded Transaction System
Review Date: January 2025
Review Type: Comprehensive Privacy Analysis and Threat Assessment
Review Scope: Transaction Privacy, Network Privacy, Metadata Leakage, and Operational Security

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Executive Summary

This privacy review examines the privacy guarantees, limitations, and operational security considerations of the zDoge.cash shielded transaction system. The analysis covers cryptographic privacy mechanisms, network-level privacy risks, transaction correlation vectors, and user operational security requirements.

The system implements zero-knowledge proof-based privacy similar to Zcash, providing strong cryptographic guarantees for shielded transfers while maintaining necessary transparency for shield and unshield operations. This review identifies privacy strengths, documents inherent limitations, and provides actionable recommendations for users seeking various levels of privacy protection.

Privacy Rating: 8.5/10
Cryptographic Privacy: 9/10
Network Privacy: 6/10 (requires user action)
Operational Privacy: 7/10 (user-dependent)

Overall Assessment: The system provides strong cryptographic privacy for shielded operations, but users must implement additional operational security measures to achieve comprehensive privacy protection.

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1. Privacy Guarantees

1.1 Cryptographic Privacy Guarantees

Completely Hidden Information (Shielded Transfers):

The following information is cryptographically hidden from all observers, including blockchain analysis, government surveillance, and malicious actors:

Transfer Amounts: - Exact amounts transferred in shielded-to-shielded transactions are encrypted within commitments - Only the sender and recipient (via encrypted memos) know the transfer amount - Blockchain observers see only commitment hashes, which reveal no information about amounts - Zero-knowledge proofs verify transaction validity without revealing amounts

Sender Identity: - The identity of the sender in shielded transfers is completely hidden - No on-chain address or identifier links the transfer to a specific user - Multiple users in the shielded pool provide anonymity set protection - Zero-knowledge proofs verify ownership without revealing which note was spent

Recipient Identity: - The recipient's shielded address is never published on-chain - Encrypted memos ensure only the intended recipient can decrypt and claim transfers - Auto-discovery mechanism allows recipients to find their transfers without revealing their identity - No correlation between recipient address and real-world identity

Shielded Balance: - Total shielded balance per user is private and calculated locally - Only the user with the private viewing key can calculate their balance - Blockchain observers cannot determine how much any user controls - Individual note amounts are hidden within commitments

Transaction Linkability: - Individual shielded transfers cannot be linked together - Each transfer creates new commitments with no connection to previous commitments - Nullifiers prevent double-spending without revealing which note was spent - Transaction graph analysis is cryptographically prevented

1.2 Privacy Model Architecture

Merkle Tree Anonymity Set: - All shielded notes exist within a single Merkle tree - Anonymity set size equals the number of active commitments in the tree - Larger anonymity set provides stronger privacy protection - Users benefit from the collective privacy of all pool participants

Commitment-Based Privacy: - Each note is represented by a commitment hash (MiMC Sponge, 256-bit) - Commitments reveal no information about amounts, tokens, or ownership - Collision resistance ensures unique commitments per unique note - Cryptographic guarantees prevent commitment correlation

Nullifier-Based Uniqueness: - Nullifiers prevent double-spending without revealing spent notes - Each nullifier is cryptographically unique - Nullifier set tracking is public but does not reveal note details - Prevents transaction replay and double-spending attacks

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2. Privacy Limitations and Visibility

2.1 Intentionally Visible Operations

Shield Operations (Public Entry Points):

Visible Information: - Public wallet address that initiated the shield - Amount shielded (if ERC20 token, amount is visible in transfer event) - Timestamp of shield operation - Commitment hash added to Merkle tree

Hidden Information: - Which specific user owns the commitment (within anonymity set) - Future transactions using this commitment - Linkage to other shielded operations

Privacy Impact: LOW - Public wallet addresses are already known if user has transacted publicly - Shield operation does not reveal future transaction patterns - Entry point visibility is necessary for deposit functionality

Recommendation: Users should shield from addresses that are not linked to their real-world identity, or use intermediate addresses to break the link.

Unshield Operations (Public Exit Points):

Visible Information: - Recipient public address (where tokens are sent) - Amount unshielded (visible in transaction) - Timestamp of unshield operation - Nullifier hash (prevents double-spending)

Hidden Information: - Which specific note was spent (within anonymity set) - Sender's shielded address - Previous transaction history of the spent note

Privacy Impact: MEDIUM - Unshield amount and recipient are public by design (required for withdrawal) - Timing correlation with previous operations is possible - Exit point visibility is necessary for withdrawal functionality

Recommendation: Users should unshield to addresses not linked to their identity, wait between shield and unshield operations, and use different amounts to avoid correlation.

2.2 Partially Visible Operations

Partial Unshield Change Notes:

Visible Information: - New commitment appears in Merkle tree shortly after unshield event - Timing correlation: unshield event and new commitment in same or adjacent blocks - Block number of commitment creation

Hidden Information: - Exact amount in change note (encrypted in commitment) - Owner of change note (within anonymity set) - Linkage to original unshield operation (cryptographically hidden)

Privacy Impact: LOW - Timing correlation suggests change note creation but does not prove ownership - Amount in change note remains hidden - Correlation is probabilistic, not deterministic

Recommendation: Users should be aware that partial unshields create change notes that may be correlated with the withdrawal. For maximum privacy, consider unshielding the full amount or waiting before using the change note.

Token Swap Operations:

Visible Information: - Two input commitments nullified simultaneously - Two output commitments created simultaneously - Timing pattern suggests swap

occurred (not just transfer) - Block number of swap operation

Hidden Information: - Token types being swapped (if using multi-token pool) - Exact amounts of each token - Identity of swap participant - Previous history of swapped notes

Privacy Impact: LOW - Pattern suggests swap occurred but provides no identity information - Amounts and token types remain hidden - Swap provides better privacy than public DEX swaps

Recommendation: Users should be informed that swap operations may reveal the swap occurred due to timing patterns. For maximum privacy, consider using separate shield/unshield operations or multiple smaller swaps.

Shielded Pool Aggregate Data:

Visible Information: - Total number of active commitments in pool - Total value locked in shielded pool (if tokens have public prices) - Pool activity level (number of operations per time period)

Hidden Information: - Individual user balances - Individual transaction amounts - User identities and transaction patterns

Privacy Impact: NONE - Aggregate data provides no information about individual users - Pool statistics are useful for transparency without compromising privacy - No correlation possible with individual operations

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3. Privacy Threat Analysis

3.1 High-Risk Privacy Threats

Network Metadata Leakage (IP Address Correlation):

Threat Vector: 1. User queries RPC endpoint for specific commitments or events 2. RPC server logs contain: IP address, queried commitments, block ranges, timestamps 3. Attacker (controlling RPC or monitoring network traffic) correlates: IP address → commitments 4. Attacker determines: This IP address owns these commitments 5. Future queries from same IP reveal ongoing activity patterns

Attack Scenarios: - Malicious RPC provider logs all queries and correlates with user IP addresses - ISP monitoring and traffic analysis reveals RPC queries - Man-in-the-middle attack on unencrypted RPC connections - Government surveillance of network traffic

Impact: - De-anonymizes user's real-world identity (IP address → physical location → identity) - Links commitments to specific users - Reveals transaction patterns and timing - Enables correlation with other on-chain and off-chain activities

Mitigation Strategies:

VPN Usage: - Use reputable VPN service (NordVPN, ExpressVPN, Mullvad, ProtonVPN) - VPN masks IP address from RPC provider - Choose VPN provider with no-logging policy - Use VPN server in privacy-friendly jurisdiction

Tor Browser: - Use Tor Browser for maximum anonymity - Tor routes traffic through multiple relays - IP address completely hidden from RPC provider - Slower performance but maximum privacy

Self-Hosted RPC: - Run own RPC node to eliminate third-party risk - No external queries reveal user activity - Requires technical expertise and infrastructure - Best privacy but highest operational overhead

RPC Endpoint Rotation: - Rotate between multiple RPC endpoints - Prevents single point of correlation - Reduces risk but does not eliminate it - Should be implemented in frontend code

Recommendation Level: CRITICAL for high-value privacy users. All users should use at least VPN when accessing zDoge.cash.

Browser Fingerprinting:

Threat Vector: 1. Website collects browser characteristics: user agent, screen resolution, installed fonts, timezone, language, plugins 2. Combination creates unique fingerprint identifying user 3. Fingerprint persists across sessions even with VPN/Tor 4. Attacker correlates fingerprint with blockchain activity

Attack Scenarios: - Website tracks unique browser fingerprint - Third-party analytics services collect fingerprinting data - Malicious scripts extract browser characteristics - Cross-site tracking via fingerprint

Impact: - Re-identifies user even with IP address protection - Links multiple sessions to same user - Enables cross-site tracking - Reduces effectiveness of VPN/Tor

Mitigation Strategies:

Tor Browser: - Tor Browser designed to prevent fingerprinting - Standardized browser characteristics across all users - Fingerprint resistance built into design - Best protection against fingerprinting

Privacy-Focused Browsers: - Brave Browser with fingerprinting protection enabled - Firefox with privacy extensions (uBlock Origin, Privacy Badger) - Disable JavaScript for non-essential functionality - Use browser extensions that block fingerprinting

Browser Isolation: - Use separate browser profile for crypto activities - Use dedicated device for sensitive operations - Avoid mixing crypto and regular browsing

Recommendation Level: MEDIUM for privacy-conscious users. High-value users should use Tor Browser.

Transaction Amount Correlation:

Threat Vector: 1. User shields exact amount: 1,234.5678 DOGE 2. Later, user unshields exact amount: 1,234.5678 DOGE 3. Observer correlates: Same amount suggests same user 4. Additional correlation: Timing, recipient address patterns

Attack Scenarios: - Blockchain analysis correlates shield and unshield amounts - Exact amount matching suggests same user - Pattern analysis across multiple operations - Correlation with external data (exchange withdrawals, etc.)

Impact: - Links shield and unshield operations to same user - Reveals transaction patterns - Enables transaction graph construction - Reduces anonymity set effectiveness

Mitigation Strategies:

Round Number Usage: - Use round numbers when shielding (100, 500, 1000 DOGE) - Avoid unique or identifiable amounts - Standard amounts blend with other users

Time Delays: - Wait significant time between shield and unshield (days or weeks) - Break timing correlation patterns - Reduces linkability probability

Amount Variation: - Unshield different amounts than you shielded - Use partial unshields to create change notes - Mix amounts through transfers

Intermediate Transfers: - Transfer to yourself before unshielding - Adds mixing layer between shield and unshield - Breaks direct amount correlation

Recommendation Level: MEDIUM for avoiding obvious patterns. Users should vary amounts and timing.

3.2 Medium-Risk Privacy Threats

Timing Correlation:

Threat Vector: 1. User performs operations in rapid sequence: Shield → Transfer → Unshield 2. Timing pattern suggests same user performing sequential operations 3. Observer correlates operations by timestamp proximity 4. Pattern analysis reveals user behavior

Impact: - Links multiple operations to same user - Reveals transaction patterns and behavior - Enables activity profiling - Reduces privacy through pattern recognition

Mitigation: - Add random delays between operations (hours or days) - Perform operations at different times of day - Avoid predictable patterns (e.g., every Monday at 9 AM) - Vary operation timing to break correlation

Recommendation Level: LOW for most users. Only matters for sophisticated attackers with extensive monitoring capabilities.

Browser Extension Spying:

Threat Vector: 1. Malicious browser extension installed by user 2. Extension has access to localStorage and page content 3. Extension reads shielded wallet secret keys from localStorage 4. Attacker exfiltrates keys and can decrypt all user notes

Impact: - Complete loss of privacy (all notes decryptable) - Potential loss of funds (if spending keys compromised) - No recovery mechanism once keys are exposed

Mitigation: - Only install trusted browser extensions from verified sources - Review extension permissions carefully before installation - Use dedicated browser profile for crypto activities - Regularly audit installed extensions - Consider hardware wallet integration (future feature)

Recommendation Level: MEDIUM - Basic security hygiene. All users should be cautious with browser extensions.

3.3 Low-Risk Privacy Threats

Transaction History in localStorage:

Threat Vector: 1. Transaction history stored unencrypted in browser localStorage 2. Physical access to device or browser compromise 3. Attacker reads transaction history from localStorage 4. Reveals transaction patterns and amounts

Impact: - Local device compromise reveals transaction patterns - Does not reveal on-chain privacy (that remains protected) - Physical access required for exploitation

Mitigation: - Clear transaction history regularly (Settings → Clear History) - Use disk encryption (BitLocker on Windows, FileVault on macOS) - Lock device when not in use - Use strong device passwords/PINs

Recommendation Level: LOW - Requires physical device access. Standard device security practices sufficient.

Notification Timing Patterns:

Threat Vector: 1. Notifications appear immediately when transfers are received 2. Attacker monitoring user's screen sees notifications in real-time 3. Timing reveals when user is receiving funds 4. Pattern analysis reveals activity levels

Impact: - Reveals timing of incoming transfers (but not sender identity) - Minor privacy leak in public settings - Does not compromise cryptographic privacy

Mitigation: - Disable notifications in public places - Use notification batching (already implemented in system) - Configure notification privacy settings

Recommendation Level: LOW - Minor UX issue only. Notification batching already implemented.

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4. Privacy Protection Levels

4.1 Basic Protection (Level 1)

Target Users: Everyday users seeking basic financial privacy

Effort Required: Low
Privacy Achieved: Good
Usability Impact: Minimal

Required Practices: - Use VPN when accessing zDoge.cash - Use round numbers for shields and unshields (100, 500, 1000 DOGE) - Wait at least 24 hours between shield and unshield operations - Clear transaction history monthly - Use device encryption and strong passwords

Privacy Guarantees: - Cryptographic privacy for shielded transfers (maintained) - Basic network privacy (IP address protected) - Reduced amount correlation (round numbers) - Standard device security (encryption)

Limitations: - Browser fingerprinting still possible - Timing correlation still possible with sophisticated attackers - Amount correlation possible if patterns are obvious

Suitable For: - Users seeking basic financial privacy - Protection against casual observers - Everyday cryptocurrency users - Users with moderate privacy needs

4.2 Enhanced Protection (Level 2)

Target Users: Privacy-conscious users, activists, journalists

Effort Required: Medium
Privacy Achieved: Very Good
Usability Impact: Moderate

Required Practices: - All Level 1 practices - Use Tor Browser instead of regular browser - Transfer to yourself before unshielding (adds mixing layer) - Vary transaction amounts (avoid using same amount repeatedly) - Use different times of day for operations - Wait several days between shield and unshield - Use separate browser profile for crypto activities

Privacy Guarantees: - All Level 1 guarantees - Browser fingerprinting protection (Tor Browser) - Enhanced mixing through self-transfers - Reduced timing correlation - Amount pattern obfuscation

Limitations: - Still requires trust in Tor network - Slower performance due to Tor routing - Some usability trade-offs

Suitable For: - Privacy-conscious individuals - Activists and journalists - Users with moderate privacy needs - Protection against determined observers

4.3 Maximum Protection (Level 3)

Target Users: High-value users, political dissidents, whistleblowers

Effort Required: High
Privacy Achieved: Excellent
Usability Impact: Significant

Required Practices: - All Level 2 practices - Run own RPC node (eliminate RPC provider risk) - Use Tails OS (amnesic operating system) - Never reuse the same shielded address - Mix funds through multiple hops (transfer multiple times) - Use burner devices (separate device for crypto only) - Never link to real-world identity (fresh email, username, etc.) - Use cash or privacy coins for on/off-ramping - Avoid discussing zDoge.cash usage publicly - Use separate identities for all crypto activities

Privacy Guarantees: - All Level 2 guarantees - Complete elimination of RPC provider risk - Amnesic operating system prevents local data leakage - Maximum mixing through multiple transaction hops - Complete identity separation - Protection against sophisticated adversaries

Limitations: - Significant operational overhead - Requires technical expertise - High usability impact - May still be vulnerable to global adversaries with extensive resources

Suitable For: - High-value users requiring maximum privacy - Political dissidents and activists in repressive regimes - Whistleblowers and journalists investigating sensitive topics - Protection against sophisticated state-level adversaries

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5. Privacy Comparison Analysis

5.1 Comparison with Traditional Cryptocurrency

Transaction Amount Privacy: - zDoge.cash: Hidden (encrypted in commitments) - Traditional Crypto: Public (visible on blockchain) - Advantage: zDoge.cash provides complete amount privacy

Sender/Recipient Privacy: - zDoge.cash: Hidden (no addresses on-chain for transfers) - Traditional Crypto: Public (addresses visible on blockchain) - Advantage: zDoge.cash provides complete identity privacy

Balance Privacy: - zDoge.cash: Private (calculated locally, not on-chain) - Traditional Crypto: Public (address balances visible) - Advantage: zDoge.cash

provides complete balance privacy

Transaction History Privacy: - zDoge.cash: Private (stored locally, not linkable on-chain) - Traditional Crypto: Public (permanent blockchain record) - Advantage: zDoge.cash provides transaction history privacy

Network Metadata: - zDoge.cash: Requires VPN/Tor (same as traditional crypto) - Traditional Crypto: Requires VPN/Tor - Advantage: Equal (both require user action)

5.2 Comparison with Bank Accounts

Transaction Amount Privacy: - zDoge.cash: Hidden - Bank Account: Visible to bank, potentially to government - Advantage: zDoge.cash provides better privacy

Sender/Recipient Privacy: - zDoge.cash: Hidden - Bank Account: Visible to bank, potentially to government - Advantage: zDoge.cash provides better privacy

Balance Privacy: - zDoge.cash: Private - Bank Account: Visible to bank, potentially to government - Advantage: zDoge.cash provides better privacy

Regulatory Compliance: - zDoge.cash: User responsible - Bank Account: Bank handles compliance - Advantage: Bank provides compliance convenience, zDoge.cash provides privacy

5.3 Comparison with Other Privacy Coins

Privacy Model: - zDoge.cash: Zcash-style shielded pool (similar to Zcash, Zcoin) - Monero: Ring signatures and stealth addresses - Dash: CoinJoin mixing

Privacy Guarantees: - zDoge.cash: Strong cryptographic guarantees (zero-knowledge proofs) - Monero: Strong privacy with larger anonymity set - Dash: Weaker privacy (mixing is probabilistic)

Usability: - zDoge.cash: Good (familiar Ethereum-like interface) - Monero: Good (mature ecosystem) - Dash: Good (optional privacy)

Anonymity Set: - zDoge.cash: Depends on pool size (grows with adoption) - Monero: Large (all users in ring) - Dash: Variable (depends on mixing participation)

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6. Operational Security Recommendations

6.1 Network Security

Critical Recommendations: 1. Always use VPN or Tor when accessing zDoge.cash 2. Avoid public WiFi without VPN protection 3. Consider running

own RPC node for maximum privacy 4. Rotate RPC endpoints if using multiple providers

Implementation: - Configure VPN before accessing zDoge.cash - Use Tor Browser for maximum anonymity - Verify VPN connection is active before transactions - Test RPC endpoint connectivity before critical operations

6.2 Device Security

Critical Recommendations: 1. Enable full disk encryption (BitLocker, FileVault, LUKS) 2. Use strong device passwords/PINs 3. Lock device when not in use 4. Use dedicated device or browser profile for crypto activities

Implementation: - Enable encryption on all devices used for crypto - Use password managers for strong, unique passwords - Configure automatic device locking - Create separate user profile or browser profile

6.3 Transaction Patterns

Critical Recommendations: 1. Use round numbers for shields and unshields 2. Wait significant time between shield and unshield 3. Vary transaction amounts to avoid patterns 4. Use intermediate transfers to add mixing

Implementation: - Plan transactions to use standard amounts (100, 500, 1000) - Schedule operations with delays between them - Randomize transaction amounts within reasonable ranges - Transfer to yourself before unshielding

6.4 Identity Separation

Critical Recommendations: 1. Never link shielded address to real-world identity 2. Use separate email addresses for crypto activities 3. Avoid discussing zDoge.cash usage on social media 4. Use pseudonyms for community participation

Implementation: - Create fresh email address for crypto activities - Use pseudonym for Discord, forums, etc. - Avoid posting transaction hashes or addresses publicly - Separate crypto identity from real-world identity

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7. Privacy Audit Checklist

7.1 Network Privacy Assessment

Checklist Items: - [ ] I use a VPN or Tor when accessing zDoge.cash - [ ] I avoid public WiFi or use VPN on public networks - [ ] I clear my browser history regularly - [ ] I use Tor Browser or privacy-focused browser - [ ] I have considered running my own RPC node

Scoring: - 5 checks: Excellent network privacy posture - 3-4 checks: Good network privacy, room for improvement - 1-2 checks: Moderate network privacy, significant gaps - 0 checks: Weak network privacy, critical vulnerabilities

7.2 Transaction Privacy Assessment

Checklist Items: - [ ] I use round numbers for shields (100, 500, 1000) - [ ] I wait at least 24 hours between shield and unshield - [ ] I vary my transaction amounts - [ ] I transfer to myself to add mixing - [ ] I use different times of day for operations

Scoring: - 5 checks: Excellent transaction privacy posture - 3-4 checks: Good transaction privacy, room for improvement - 1-2 checks: Moderate transaction privacy, significant gaps - 0 checks: Weak transaction privacy, high correlation risk

7.3 Device Privacy Assessment

Checklist Items: - [ ] My device has disk encryption enabled - [ ] I use a strong device password/PIN - [ ] I lock my device when not in use - [ ] I only install trusted browser extensions - [ ] I use a separate browser profile for crypto

Scoring: - 5 checks: Excellent device privacy posture - 3-4 checks: Good device privacy, room for improvement - 1-2 checks: Moderate device privacy, significant gaps - 0 checks: Weak device privacy, high risk of compromise

7.4 Operational Privacy Assessment

Checklist Items: - [ ] I don't discuss my zDoge.cash usage publicly - [ ] I don't link my shielded address to social media - [ ] I use different identities for crypto (separate email, etc.) - [ ] I avoid predictable transaction patterns - [ ] I understand the privacy limitations of shield/unshield

Scoring: - 5 checks: Excellent operational privacy posture - 3-4 checks: Good operational privacy, room for improvement - 1-2 checks: Moderate operational privacy, significant gaps - 0 checks: Weak operational privacy, high identity correlation risk

7.5 Overall Privacy Score

Calculation: - Sum scores from all four categories (Network, Transaction, Device, Operational) - Maximum possible score: 20 points

Interpretation: - 18-20 points: Excellent privacy posture, maximum protection - 14-17 points: Good privacy posture, minor improvements possible - 10-13 points: Moderate privacy posture, significant improvements needed - 6-9 points: Weak privacy posture, critical vulnerabilities - 0-5 points: Very weak privacy posture, immediate action required

8. Frequently Asked Questions

8.1 Government Surveillance

Q: Can the government track my zDoge.cash transactions?

A: Shielded transfers are cryptographically private - even governments cannot see sender, recipient, or amounts. However:

- They CAN see when you shield/unshield (entry/exit points are public)
- They CAN monitor your IP address (use VPN/Tor to mitigate)
- They CAN compel you to disclose your private keys (jurisdictional risk)
- They CAN analyze transaction patterns if you don't follow privacy best practices

Recommendation: Use zDoge.cash legally and responsibly. Privacy does not mean illegal activity. Implement operational security measures to protect against surveillance.

8.2 Device Compromise

Q: If someone steals my device, can they access my shielded funds?

A: Access depends on device security:

- Physical access to unlocked device: YES, they can access funds if keys are in memory
- Physical access to locked device: NO, if full disk encryption is enabled
- Stolen backup phrase: YES, they can recover everything
- Browser extension compromise: YES, if extension has access to keys

Recommendation: - Enable full disk encryption on all devices - Use strong device passwords/PINs - Store backup phrase offline in secure location (paper in safe) - Lock device when not in use - Only install trusted browser extensions

8.3 Service Provider Visibility

Q: Can zDoge.cash see my transactions?

A: NO. The zDoge.cash frontend runs entirely in your browser. The service cannot see:

- Your private keys (generated and stored locally)
- Your shielded balance (calculated locally)
- Your transaction details (created locally with zero-knowledge proofs)
- Your transaction history (stored locally in browser)

The only data that leaves your browser are encrypted blockchain transactions submitted to the relayer.

Note: The backend indexer service maintains Merkle tree state but cannot see individual user transactions or balances.

8.4 Service Availability

Q: What happens if zDoge.cash website goes offline?

A: Your funds are safe. The smart contracts exist on the DogeOS blockchain, not on the website. You can:

- Use alternative frontend interfaces (if available)
- Interact directly with smart contracts using block explorers
- Wait for website to come back online (funds remain accessible)
- Use your backup phrase with compatible wallet software (if developed)

Recommendation: Save your backup phrase - it's the ultimate recovery mechanism. Funds are stored on-chain, not on the website.

8.5 Blockchain Analysis

Q: Can I be traced by analyzing the blockchain?

A: Shielded pool transactions use zero-knowledge proofs, making tracing extremely difficult:

- Transfer amounts are hidden (encrypted commitments)
- Sender/recipient are hidden (no addresses on-chain)
- Transaction graph analysis is prevented (cryptographic unlinkability)

However, entry/exit points are visible:

- Shield: Public wallet → Shielded pool (visible)
- Unshield: Shielded pool → Public wallet (visible)

Best Practice: Mix funds by transferring to yourself between shield/unshield to break linkability.

8.6 Swap Privacy

Q: How private is "swap" compared to external DEX swaps?

A: Shielded swaps are MORE private than traditional DEX swaps:

Traditional DEX: - Sender address visible - Token amounts visible - Swap direction visible (DOGE→USDC) - Wallet balance visible before/after

zDoge.cash Shielded Swap: - Sender hidden - Amounts hidden (encrypted) - Swap occurred (visible pattern: 2 nullifiers → 2 commitments) - Balance hidden

Note: Swap pattern is visible (timing suggests swap), but identity and amounts remain hidden.

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9. Legal and Regulatory Considerations

9.1 Legal Obligations

Tax Reporting: - Users are responsible for tax reporting in their jurisdiction - Shielded transactions may still be subject to tax obligations - Consult with tax professional familiar with cryptocurrency regulations - Maintain records of shield/unshield operations for tax purposes

AML/KYC Compliance: - Using zDoge.cash does not exempt users from AML/KYC requirements - Exchanges used for on/off-ramping may require KYC - Users must comply with local regulations when converting to/from fiat - Privacy tools are legal, but using them for illegal activity is not

Import/Export Regulations: - Some countries restrict cryptography and privacy tools - Users should verify legality in their jurisdiction - Export controls may apply to cryptographic software - Consult legal counsel if uncertain about regulations

9.2 Responsible Use

Privacy is a Human Right: - Financial privacy is a fundamental right - Privacy tools enable legitimate privacy protection - Privacy does not imply illegal activity

Rights Come with Responsibilities: - Users must comply with applicable laws - Privacy tools should not be used for illegal purposes - Users are responsible for their own actions

Recommendation: Use zDoge.cash legally and responsibly. Understand your local regulations and comply with applicable laws.

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10. Conclusion

The zDoge.cash system provides strong cryptographic privacy guarantees for shielded transactions. The zero-knowledge proof architecture ensures that transfer amounts, sender identity, recipient identity, and balances remain hidden from all observers, including blockchain analysis and government surveillance.

However, privacy is not absolute. Entry and exit points (shield/unshield operations) are intentionally visible to enable functionality. Network metadata, transaction patterns, and operational security all play critical roles in achieving comprehensive privacy protection.

Users seeking maximum privacy must implement operational security measures beyond the cryptographic guarantees. This includes using VPN/Tor, following transaction pattern best practices, securing devices, and maintaining identity separation.

Key Takeaways: 1. Cryptographic privacy for shielded transfers is strong and reliable 2. Operational security is essential for comprehensive privacy protection 3. Users should choose privacy protection level appropriate to their threat model 4. Privacy is a process, not a destination - stay informed and adapt practices

Final Recommendation: The system provides excellent cryptographic privacy foundations. Users should implement appropriate operational security measures based on their privacy needs and threat model. For most users, Level 1 (Basic Protection) is sufficient. For high-risk users, Level 3 (Maximum Protection) should be implemented.

Review Completed By: Privacy Analysis Team
Report Version: 1.1 (Updated for V4 deployment - January 2025)
Next Review Recommended: Quarterly or after major privacy feature updates