

Economics of Road Safety

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Outline

01

The rationale for estimating the cost of road crashes

02

Methods to estimate cost of road crashes

03

Applying cost of road crashes locally in Africa



01

The Rationale for Estimating the Cost of Road Crashes

Why Cost Estimation Matters

Policy Development Framework

Strategy Development

Cost data supports the development of comprehensive road safety strategies

Intervention Comparison

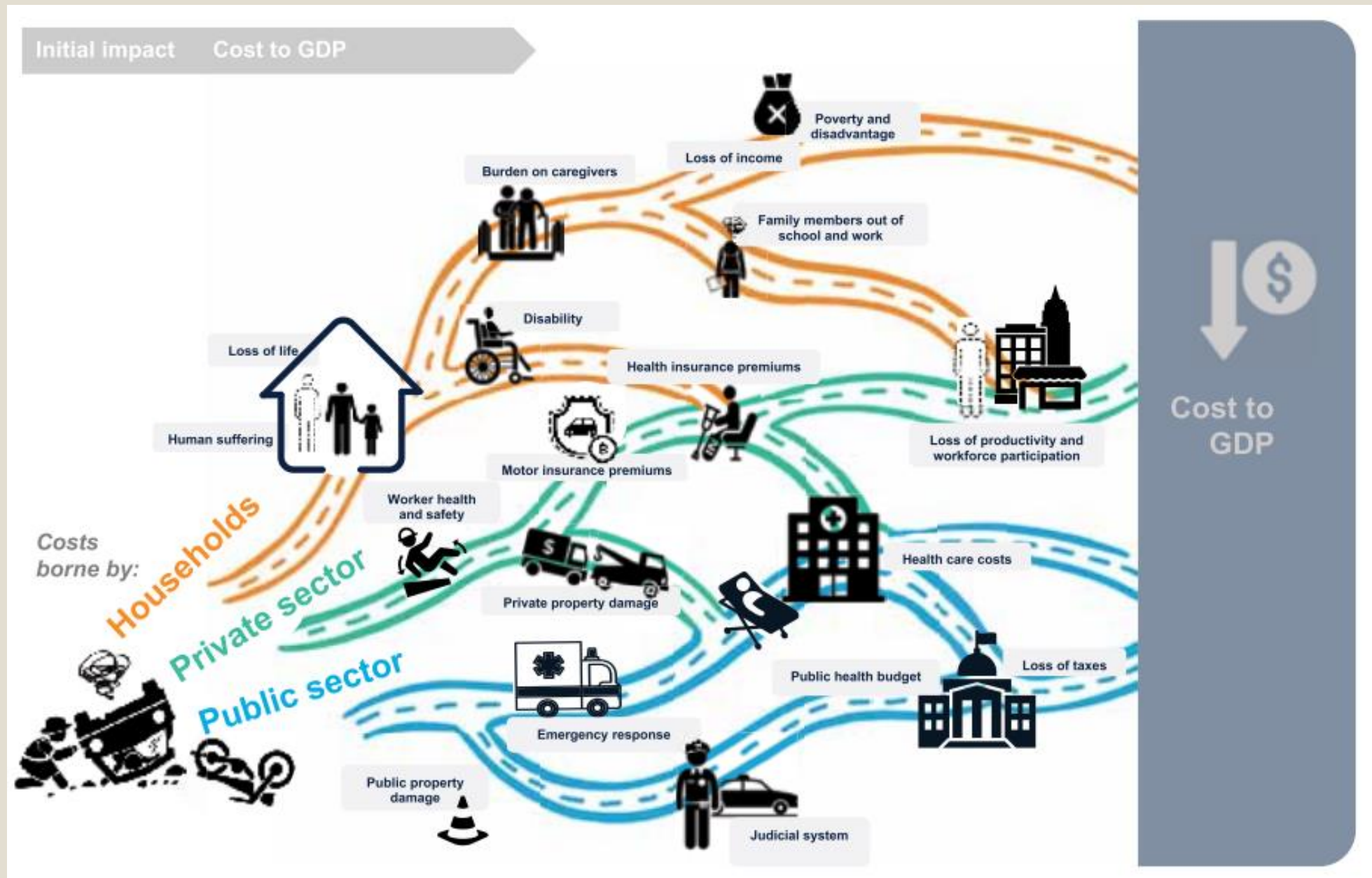
Enables comparison of different intervention options and their cost-effectiveness

Budget Allocation

Facilitates budget allocation for infrastructure improvements, enforcement, and education

Legal Framework

Supports legal framework development including insurance policies and compensation schemes



Source: World Bank Group, Mobility and Transport Connectivity Series, 2022

Key Stakeholders and Their Interests

Government and Public Sector



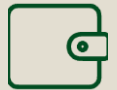
Ministry of Transport

Infrastructure investment priorities



Ministry of Health

Healthcare system burden and resource planning



Ministry of Finance

Economic impact assessment and budget allocation



Traffic Police

Enforcement strategy development and resource needs

Key Stakeholders and Their Interests

Private Sector



Insurance Companies

Premium calculation and risk assessment



Employers

Workplace safety policies and fleet management



Healthcare Providers

Service planning and capacity management



Automotive Industry

Safety feature development and marketing

Key Stakeholders and Their Interests

International Organizations

World Health Organization

Global health burden assessment

African Development Bank

Regional infrastructure investment priorities

World Bank

Development financing and economic analysis

UN Sustainable Development Goals

Progress monitoring (SDG 3.6)

Economic Justification Categories

Direct Economic Losses

Immediate Costs

Medical treatment, emergency response, vehicle damage

Property Damage

Infrastructure repair, traffic management systems

Administrative Costs

Police investigation, legal proceedings, insurance processing

Productivity Loss

Workdays lost, reduced earning capacity

Economic Justification Categories

Indirect Economic Impacts

- Human Capital Loss: Lifetime earnings potential of victims
- Family Impact: Reduced household income, increased care responsibilities
- Social Services: Long-term care, disability support, social welfare
- Economic Multiplier Effects: Reduced consumer spending, business disruptions

Intangible Costs

- Quality of Life: Pain, suffering, and reduced life satisfaction
- Social Cohesion: Community trauma and reduced social trust
- Psychological Impact: Mental health treatment, family counseling
- Cultural Loss: Traditional knowledge, community leadership



02

Methods to Estimate Cost of Road Crashes

Overview of Estimation Approaches

Three Primary Methodological Frameworks

1

Human Capital Approach (HCA)

Values human life based on productive capacity and future earnings

2

Willingness to Pay Approach (WTP)

Measures what individuals are willing to pay to reduce risk of death or injury

3

Cost of Illness Approach (COI)

Focuses on direct medical costs and productivity losses

Method 1: Human Capital Approach (HCA)

Theoretical Foundation

- Values human life based on productive capacity and future earnings
- Calculates present value of expected lifetime earnings lost due to death or disability
- Most commonly used method globally due to data availability and simplicity

HCA: Calculation Components

For Fatalities:

- **Lost lifetime earnings = Annual income × Expected working years × Discount factor**
- **Account for age, gender, education level, and occupation**
- **Include both formal and informal sector earnings**

For Injuries:

- **Medical costs + Lost productivity during recovery period**
- **Permanent disability adjustments based on severity**
- **Long-term care and rehabilitation costs**

HCA: Mathematical Framework

Present Value of Lost Earnings = $\Sigma(\text{Annual Earnings} \times \text{Survival Probability}) / (1 + \text{discount rate})^t$

Where: t = years from current age to retirement

HCA: Advantages and Limitations

Advantages:

- Relatively straightforward calculation
- Uses readily available economic data
- Widely accepted by policy makers
- Enables international comparisons

Limitations:

- Undervalues non-productive members (children, elderly, unemployed)
- Doesn't capture intangible costs (pain, suffering)
- May perpetuate social inequalities in valuation
- Difficult to account for informal economy contributions

Method 2: Willingness to Pay Approach (WTP)

Theoretical Foundation

- Based on consumer choice theory and revealed preferences
- Measures what individuals are willing to pay to reduce risk of death or injury
- Captures both tangible and intangible values of life and health

WTP: Data Collection Methods

Stated Preference Surveys:

- Contingent valuation questionnaires
- Choice experiments and trade-off scenarios
- Directly ask individuals about willingness to pay for safety improvements

Revealed Preference Analysis:

- Analyze actual market choices that involve risk trade-offs
- Wage premiums for high-risk occupations
- Housing prices in high vs. low accident rate areas
- Consumer spending on safety equipment

WTP: Value of Statistical Life (VSL) Calculation


$$\text{VSL} = (\text{Wage Premium for Risk}) / (\text{Additional Risk Level})$$

- Typically ranges from \$1-10 million in developed countries
- Requires adjustment for income levels and cultural factors in developing countries

WTP: Advantages and Limitations

Advantages:

- Captures full economic value including intangible costs
- Theoretically more comprehensive than HCA
- Reflects individual preferences and societal values
- Better for cost-benefit analysis of interventions

Limitations:

- Data intensive and expensive to collect
- Results can vary significantly based on survey design
- Cultural and educational factors affect responses
- May be unreliable in low-income settings

Method 3: Cost of Illness Approach (COI)

Theoretical Foundation

- Focuses on direct medical costs and productivity losses
- Bottom-up approach itemizing all accident-related expenses
- Particularly useful for understanding healthcare system burden

COI: Cost Categories



Direct Medical Costs

- Emergency medical services and ambulance transport
- Hospital treatment (emergency, surgery, intensive care)
- Rehabilitation services and physical therapy
- Long-term care and disability support services
- Pharmaceutical costs and medical equipment



Indirect Costs

- Lost wages during treatment and recovery
- Caregiver time and opportunity costs
- Transportation costs for medical appointments
- Home modifications for disabled victims

COI: Data Requirements



Medical Records

Detailed medical records and treatment protocols



Healthcare Pricing

Healthcare pricing information (public and private)



Insurance Claims

Insurance claim databases



Employment Data

Employer absence records and wage data



Household Data

Household expenditure surveys

COI: Advantages and Limitations

Advantages:

- Provides detailed breakdown of cost components
- Useful for healthcare system planning
- Relatively objective and verifiable data
- Good for understanding resource allocation needs

Limitations:

- Doesn't capture intangible costs
- May miss informal care and treatment
- Focuses primarily on injury costs, less on fatalities
- Requires extensive data collection systems

Hybrid and Advanced Methods



Integrated Approaches

- Combine elements from multiple methods
- Use HCA for productivity losses and WTP for intangible costs
- Adjust methods based on data availability and cultural context



Quality-Adjusted Life Years (QALY)

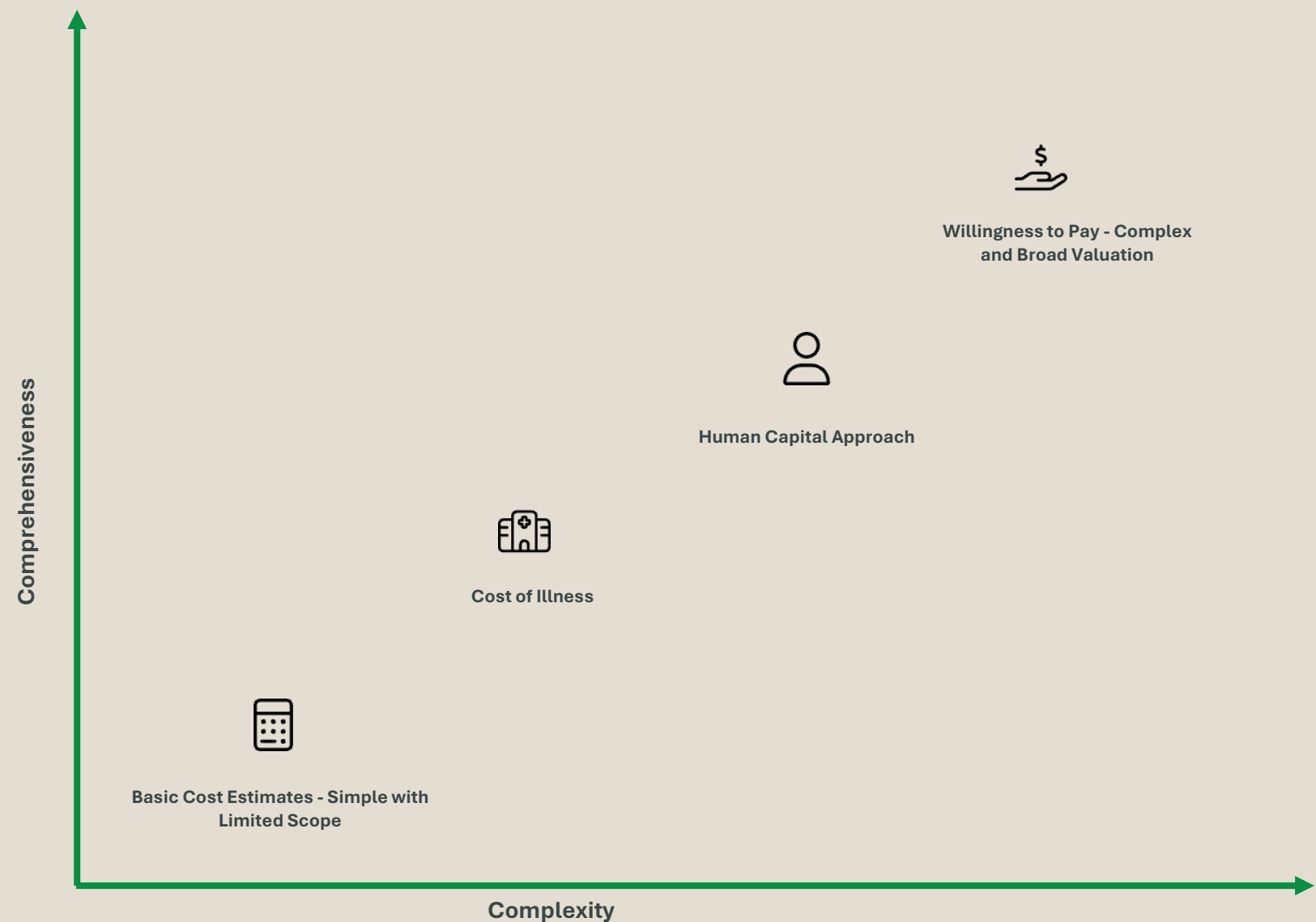
- Measures both length and quality of life impacts
- Assigns utility values to different health states
- Useful for comparing health interventions across sectors



Disability-Adjusted Life Years (DALY)

- WHO methodology combining years of life lost and years lived with disability
- Standardized approach enabling international comparisons
- Particularly relevant for burden of disease studies

Comparison of Estimation Methods



Summary: Choosing the Right Method

Consider Available Data

HCA requires income data, WTP requires survey capabilities, COI requires detailed medical records

Assess Resource Constraints

Budget, time, and expertise available for the analysis

Determine Study Purpose

Policy analysis, healthcare planning, or comprehensive social cost assessment

Consider Using Multiple Methods

Hybrid approaches can provide more comprehensive and robust estimates

03

Applying Cost of Road Crashes Locally in Africa



African Context and Challenges

Infrastructure Challenges

- Limited road network coverage and poor road conditions
- Mixed traffic (vehicles, motorcycles, bicycles, pedestrians)
- Inadequate traffic management systems and signage
- Rapid urbanization outpacing infrastructure development

Socioeconomic Factors

- Large informal economy difficult to quantify
- Limited insurance penetration and social safety nets
- High dependency ratios and extended family structures
- Income inequality affecting access to safer transport options

Data Limitations

- Underreporting of accidents, especially minor injuries
- Limited hospital and insurance databases
- Weak vital registration systems
- Inconsistent data collection methods across countries

Data Collection Strategies for African Countries

Primary Data Sources

Health Sector

- Hospital admission records and emergency department data
- Mortuary records and cause of death registration
- Health insurance claim databases where available
- Community health worker reports

Transport Sector

- Police accident reports and traffic citation records
- Vehicle registration and licensing data
- Public transport operator records
- Insurance company claim databases

Economic Data

- National household expenditure surveys
- Labor force surveys and employment statistics
- National accounts and GDP disaggregation
- Banking and financial sector transaction data



Addressing Data Gaps

Community-Based Data Collection

- ☐ Engage traditional leaders and community organizations
- ☐ Train local data collectors in accident reporting
- ☐ Use mobile technology for real-time data capture
- ☐ Implement community-based surveillance systems

Innovative Data Sources

- ☐ Mobile phone location data for traffic patterns
- ☐ Satellite imagery for infrastructure assessment
- ☐ Social media monitoring for accident reporting
- ☐ Private sector partnerships for data sharing

Methodological Adaptations for Africa

Human Capital Approach Modifications

Informal Sector Integration

- Use household surveys to estimate informal earnings
- Include subsistence agriculture and unpaid household work
- Account for seasonal employment variations
- Consider migration patterns and remittance flows

Life Expectancy Adjustments

- Incorporate HIV/AIDS impact on life expectancy
- Adjust for malaria and other endemic diseases
- Consider conflict and political instability effects
- Account for improving healthcare access trends

Cost of Illness Adaptations

Healthcare System Variations

- Include both public and private healthcare costs
- Account for out-of-pocket payments and informal payments
- Consider traditional healing practices and costs
- Include medical tourism for serious cases

Family and Community Costs

- Extended family care responsibilities
- Community fundraising for medical expenses
- Lost productivity of caregivers
- Cultural and religious ceremony costs

Policy Applications and Recommendations



Investment Prioritization

- Use cost estimates to prioritize road improvement projects
- Cost-benefit analysis of traffic management systems
- Evaluate pedestrian and cyclist infrastructure needs
- Assess public transport safety investments



Institutional Strengthening

- Improve accident data collection and reporting systems
- Strengthen traffic law enforcement capabilities
- Develop emergency medical response systems
- Build insurance and compensation frameworks



Regional Cooperation

- Develop standardized cost estimation protocols
- Share best practices and lessons learned
- Create regional databases for comparison
- Coordinate cross-border transport safety initiatives



Capacity Building

- Train local researchers in cost estimation methods
- Develop university curricula on road safety economics
- Support government agency technical capacity
- Foster public-private partnerships for research

Implementation Framework

Phase 1: Foundation Building (Years 1-2)

- Conduct pilot studies in major urban areas
- Train core team of researchers and analysts
- Establish data collection protocols and systems
- Develop partnerships with key stakeholders

1

2

Phase 2: National Implementation (Years 2-4)

- Scale up data collection to national level
- Refine methodologies based on pilot results
- Conduct comprehensive national cost studies
- Integrate findings into policy development

Phase 3: Institutionalization (Years 4-5)

- Establish permanent monitoring systems
- Create regular reporting and update mechanisms
- Build sustainable funding for ongoing research
- Develop regional comparison frameworks

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Conclusion and Key Takeaways

Critical Success Factors



Thank you!

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