

Infrastructure Development



TOWARDS A MULTI-MODAL APPROACH

***OMAR MCFARLANE-SWEENEY, BSCE, M. ENG.,
LOY C. MALCOLM, B Sc., M.PHIL.***

Background



- World Bank projects that countries expend 2.2% (1% - maintenance) of GDP annually for infrastructure development
- Vulnerable (Hazard risk) States e.g. Jamaica & Haiti will require another 1%
- Jamaica requires 3.2% (J\$41 billion) of GDP for infrastructure
- In the case of Jamaica when the significant numbers of the housing industry are added, this stands at an average of 8.3% in 2003 – 2008
- Government is the single largest contributor



- **Main driver of economic development**
- **Jamaica has continued to invest heavily in capital project, however growth continues to lag**
- **PIOJ in its Growth Inducement Strategy paper in March 2011 presents some reasons, and these are linked to the approach to capital investment (of which infrastructure development is a large part)**

Analyzing the Numbers



- Economic growth is pegged to how well we translate our capital investments to growth
- Question: Why hasn't our growth kept pace with our levels of investment?
- Answer: Inefficiencies on the infrastructure development process



- **Dr. Hutchinson and Prof. Harris in the 2011 Growth Strategy paper posits the following theory, where:**
 - k = Economic waste
 - K^* = true value of invested capital, using the most efficient production / construction techniques
 - K = Actual money invested (capital and operations costs)
- **Where $k = K^*/K < 1$**
- **Relative growth has eluded us as K continues to exceed K^***

How then do we introduce efficiencies to increase K^* ?



- ***K^* = true value of invested capital, using the most efficient production / construction techniques***
- This paper wishes to put forward that embracing the multi-modal approach will contribute to this.
- What is the multi-modal approach and how will this increase our K^* factor?



- Regardless of the scale of the infrastructure development, the ***approach*** to it should be the same.

- The approach must be Multi-modal



WHAT COMPRISES MULTI-MODAL



- **Multiple Considerations / Inputs being applied**
 - **Development Planning**
 - **Policy Making**
 - **Regulatory Systems / Oversight**
 - **Design Considerations**
 - **Technical, Environmental, Social, Hazard Analysis**
 - **Material Standards**
 - **Building Codes / Laws**
 - **Consultations**
 - **Labour Force**
 - **Maintenance Budget**



- **While the individual disciplines and sectors have a grasp of the various areas above, there is a lack of cohesion in how they are applied.**
- **Growth is hinged on is how successfully we refine how and when the disciplines are applied and how efficiently that is done.**

How to Apply these smoothly?



- **Step 1 - Prioritization and Identification**

- **Development Planning**

- **Policy Making**

- One of the underpinnings of economic development is an ability to forecast future demand for products and services. Like any business, good forecasting translates to earnings.



- Forecasted rural to urban drift
- Implemented policy strategies in early 90's, resulted in poverty declining from 27% in 1997 to 15% in 2007.
- Government of Jamaica, 1996 started the Jamaica Social Investment Fund (JSIF)
 - Reduce poverty
 - Basic services to rural areas
 - Reduce drift to urban centres
- Direct economic gain (12% reduction in poverty)



- **Port au Prince example – Lack of Policy and Planning**
- **Rural to Urban drift (between 1950 - present, population moved from 500,000 to 3 million)**
- **No planned infrastructure development**
- **Investments translated to economic waste**





- **Road and Highway development – Highway 2000**
- **Capital investment US\$800 million**
- **Direct Benefits**
 - travel time savings, vehicle operating, cost savings, public safety savings (reduced accident costs), rehabilitation and maintenance, cost savings on the existing highway network and savings related to other externalities (primarily air pollution related).
- **Indirect benefits (economic stimulus, employment)**
- **Benefits estimated US\$680 – 850 million**
- **Actual benefits to be quantified in the future**



- Where Infrastructure development is guided by policy, there are gains
- First step in the process is to reference the policy / planning that is driving the development
- If the proposed development does not sit within a policy or plan, NO GO
- This is the first step in adding additional value to the K^* factor



- **Step 2: Design & Implementation**
 - **Regulatory Systems / Oversight**
 - **Design Considerations**
 - **Technical, Environmental, Social, Hazard Analysis**
 - **Material Standard**
 - **Building Codes / Laws**
 - **Consultations**
 - **Labour Force**

Design and Implementation



- Haiti's earthquake in a matter of minutes in January 2010, that country lost **3% of its human capital** and racked up a bill of **US\$14 billion**
- In Haiti poor design accounted for 79% of damage to housing (largely concrete and masonry structures)
 - ✦ *Poor design and poor construction techniques of the labour force resulted in poor seismic performance.*
- USGS Haiti study “The massive human losses can be attributed to a lack of attention to earthquake-resistant design and construction practices, and absence of quality control of concrete and masonry work”



- Jamaica in a 10 year period had 10 cyclonic events resulting in damage costing **US\$ 1.3 billion, J\$57 billion for infrastructure US\$700 million**
- Jamaica's **reconstruction costs have averaged 2% of GDP** over the last 10 years, **Hurricane Ivan reconstruction price tag was 8% of GDP**
- An analysis of Jamaica's infrastructure post Hurricane Dean highlighted issues relating to inadequate **mitigation measures and maintenance** that need to be tackled.
- In particular, **land use, building practices and standards**, coastal roads and coastal ecosystems.



- **Jamaica like Haiti must make design allowances for its significant environmental and geological vulnerabilities**
- **Failure to get the design calculations (return periods, seismic loads), material quality, construction standards correct will continue to cost**
- **If investment of more than 3.2% of GDP in infrastructure is required to meet growing development needs, where will be additional 2% GDP annually for disaster reconstruction be found?**



- **Infrastructure development must be accompanied by:**
 - Application of established building codes
 - Rigorous oversight during construction
 - Adherence to strict Materials testing
 - Need for mandatory Regulatory approvals
 - Sound Design considerations and analysis (soil type, slopes stability, event return periods)
 - Rigorous environmental and hazard vulnerability analysis

How do we re-coup some of the K^* at this stage of the process?



- Promulgate the building code, Enact law
- Increase resources at the planning and regulatory authorities
- Make regulatory and local approvals mandatory
- Improve the GIS capabilities of our planning authorities
- Strengthen our research in climate change and modeling of scenarios for better planning and improved design standards
- Increase the cadre of trained construction workers

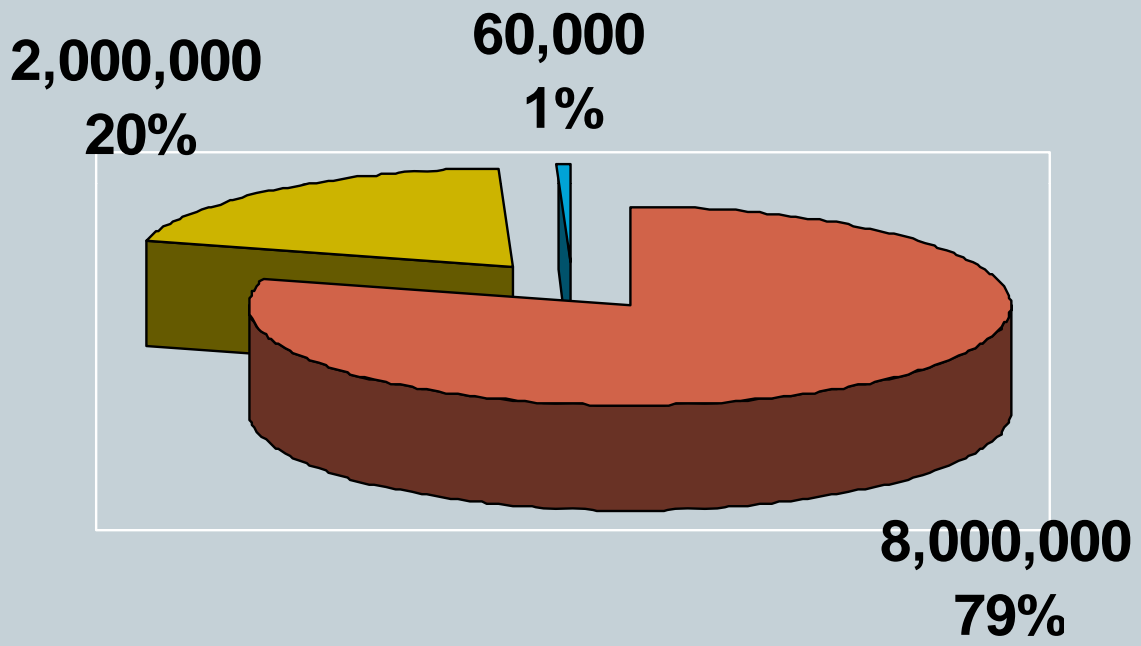
Maintenance



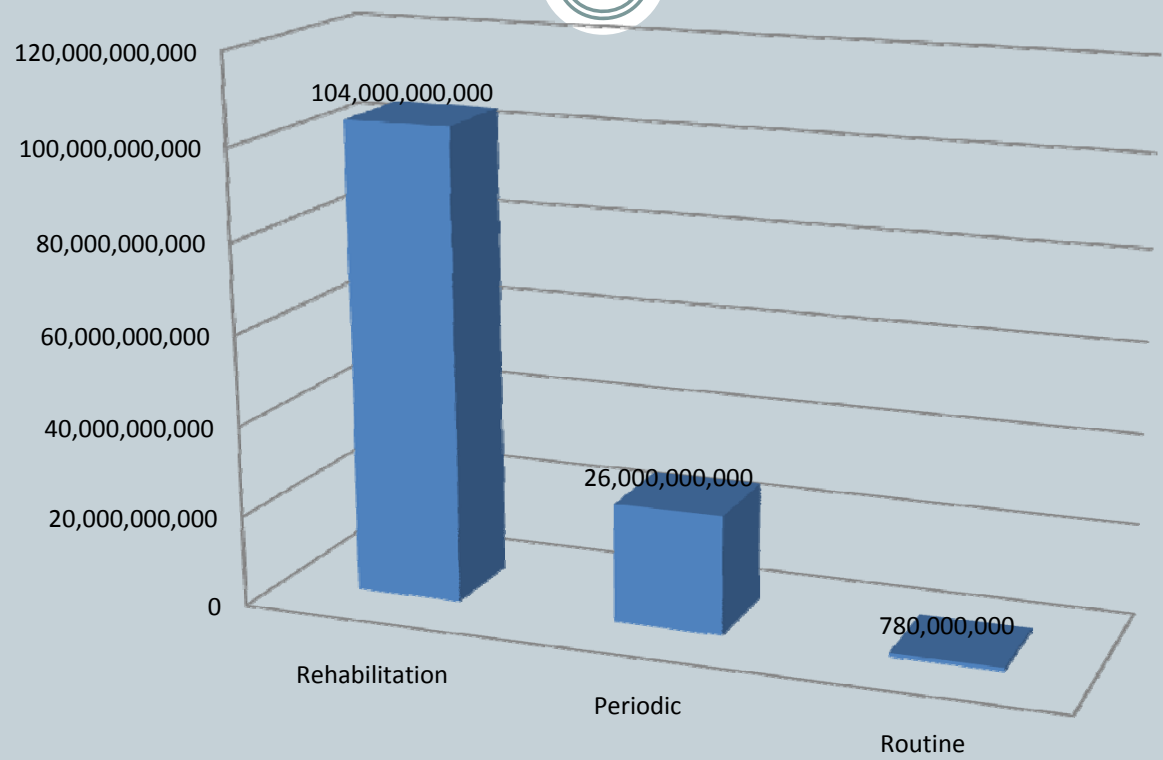
- Estimated investment required is 1% of GDP (J\$1.3 billion)
- In the Jamaican context very little budgetary allocation is made for maintenance
- Example: Parochial Road network of approximately 15000 km (represents 80% of entire road network)
- Budget allocation is **J\$800 million/ 0.06% of GDP** (rehabilitation and maintenance etc.)
 - Costs associated with road works
 - **J\$8million /km for Rehabilitation**
 - **J\$2 million / km for Periodic Maintenance**
 - **J\$60,000/km for Routine Maintenance**



Cost of Road Activities / Km



- Rehabilitation
- Periodic Maintenance
- Routine Maintenance



Rehabilitation	Periodic	Routine
J\$104,000,000,000	J\$26,000,000,000	J\$780,000,000



- Lack of maintenance results in increased capital outlay costs for rehabilitation
- The J\$ spent for maintenance translates to better returns when compared to the J\$ spent for rehabilitation
- Challenge for us is where to find the maintenance funds after construction is complete
- Solution: Design & Construction Cost + Maintenance Cost = K (money invested in the infrastructure)

Investment in Maintenance = Gains to K^* factor



- Maintenance costs should be considered in the capital cost of a project at the outset
- Maintenance cannot be ad hoc, it must be planned
- Form a part of the Operations Manual
- Poor maintenance reduces the design life of infrastructure, thus lessening the time for economic benefits to accrue

Key Points



- If neglected, (one or all of) the considerations outlined above, will contribute to failed infrastructure and reduced return on investments
- Infrastructure development is tied to economic growth
- Health of our infrastructure will define the course of our development
- Infrastructure development **goes beyond** the brick and mortar for the actual road, bridge, school or market

What lies beyond....



- **Planning and Policy**
- **Needs Identification**
- **Stakeholder Engagement / Needs Assessment**
- **Site Assessment**
- **Environment**
- **Hazard Risk**
- **Value for Money**
- **Operations and Maintenance**



- The multi-modal approach dictates that unless all the above considerations have been assessed and addressed; no infrastructure development should go forward.
- Where presently $k = K^*/K < 1$, this approach will:
 - ✦ REDUCE: $k =$ Economic waste
 - ✦ By INCREASING: $K^* =$ true value of invested capital, using the most efficient production / construction techniques
 - ✦ Create / Enable growth thereby INCREASING monies available for $K =$ Actual money invested (capital and operations costs)



**FAILURE TO EMBRACE THE MULTI-MODAL
APPROACH WILL RESULT IN WASTED
INVESTMENTS
AND
WEAK ECONOMIC GROWTH**