

CLIMATE CHANGE AND CONSTRUCTION PRACTICE IN MADHYA PRADESH

DESIGN FOR LCCR CONSTRUCTION



Defining Climate Change

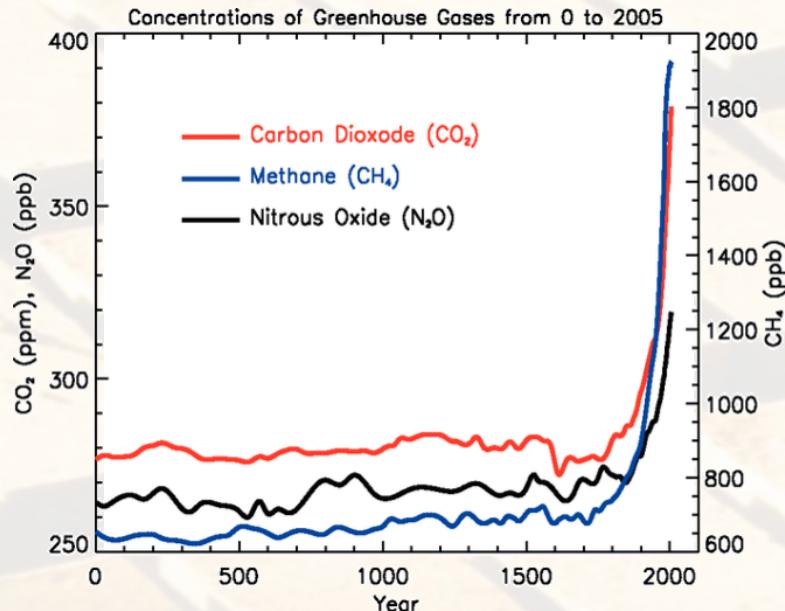
Climate is...

“ the mean and variability of relevant parameters like temperature, precipitation, and wind over a period of time, usually averaged over 30 years.”

-The Intergovernmental Panel on Climate Change

Climate change is...

the fluctuations in the “average weather” or variations in patterns of temperature, wind and precipitation over extended periods as well as the occurrence of extreme weather events.



GHG Concentrations during the last 2000 years

Source: IPCC's Fourth Assessment Report

“Human activity alters the composition of global atmosphere both directly and indirectly, and is, to a large extent, responsible for climate change.”

- United Nations Framework Convention on Climate Change

Global Impacts of Climate Change

PREDICTED CHANGE

Fluctuating precipitation patterns

Increased droughts, cyclones, floods.

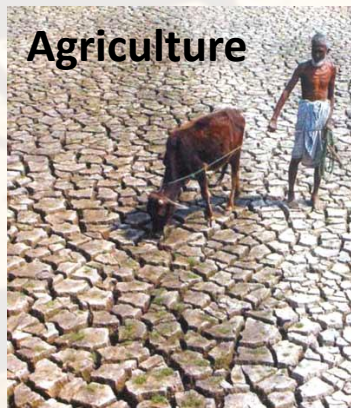
Temperature extremities

Increased heat & cold waves

Rise in sea levels

Submerging of low-lying coasts

PROJECTED IMPACTS ON



Global Impacts of Climate Change

76% of all disaster events(1988-2007)

were hydrological, meteorological or climatological in nature.

45% of deaths by natural disaster

79% of economic losses caused by natural hazards.



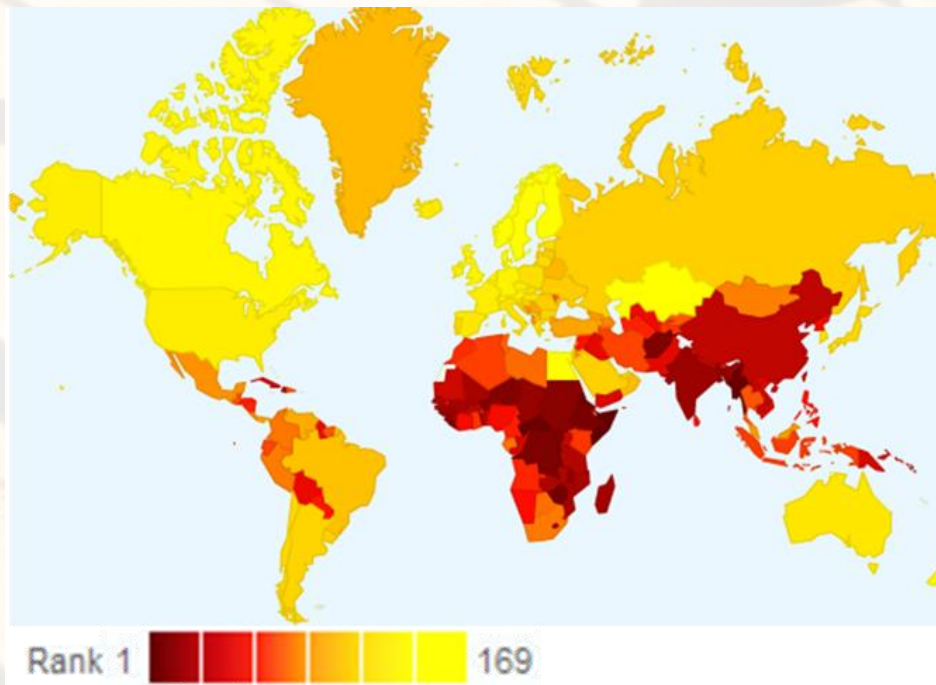
Over the period 1991-2005,

- **3,470 million people were affected by disasters**
- **960,000 people died**
- **US\$ 1,193 billion economic losses**

-International Strategy for Disaster Reduction,
United Nations

Global Impacts of Climate Change

Climate change mostly affects the developing countries of the world.
In developing countries a large proportion of the population is more strongly connected with natural resources.



Global Climate Change Vulnerability Map
Source: Centre of Global Development

“Most economies relying on agriculture and natural resources, are expected to be seriously affected by the adverse impacts of climate change.”

- IPCC 4th Assessment Report, 2007

Impacts of Climate Change in South Asia

PREDICTED CHANGE

- Increased droughts, tropical cyclones, floods
- Rise in sea level
- Rise in air and sea temperatures

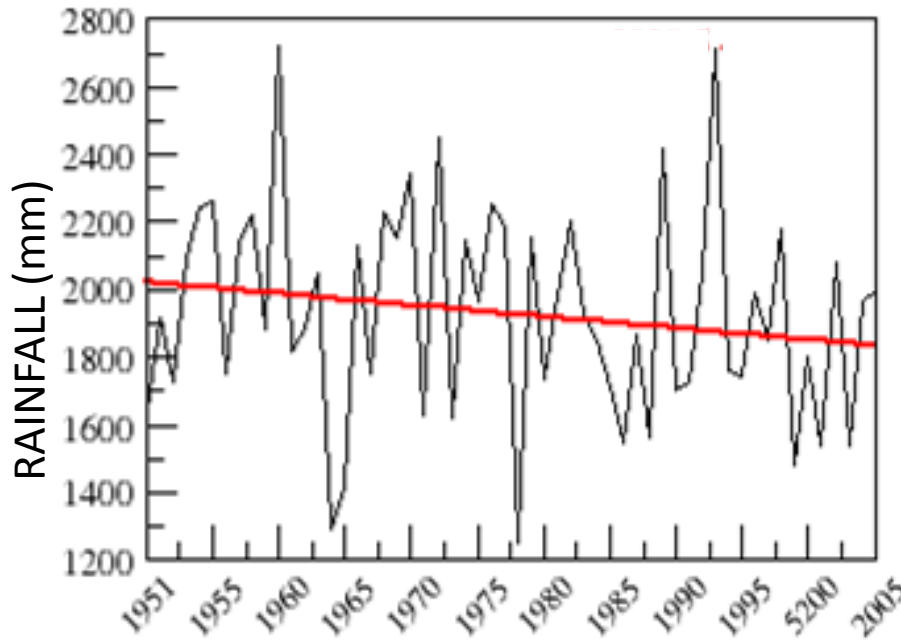
PROJECTED IMPACTS ON



Impacts of Climate Change in Madhya Pradesh

DECREASED RAINFALL

There is no clear increase in temperatures in the state in recent years but the summary of rainfall suggest decreasing rainfall trends.



Inter-annual variability of seasonal rainfall in MP from 1951-2005

RECORDED CHANGE

- Record water fluctuation from decadal average – May 1999- 2006
- 2m fall in water table levels observed in entire regional area of the State.
- Significant decrease in July rainfall in last 100 years in eastern Madhya Pradesh.

Impacts of Climate Change in Madhya Pradesh

DROUGHT

Distribution of **meteorological drought** in Bundelkhand region of Madhya Pradesh

District	Normal Rainfall(mm)	2004-05 % Deviation	2005-06 % Deviation	2006-07 % Deviation	2007-08 % Deviation
Chattarpur	984.8	-10	-9	-44	-54
Tikamgarh	971.5	-46	-28	-43	-64
Damoh	1065.4	-9	53	-27	-22
Sagar	1086.7	-12	44	-15	-35
Data	767.8	-34	-29	-47	-34
Panna	1069.6	12	33	-46	-67
Total	990.9	-16.5	10	-37	-46



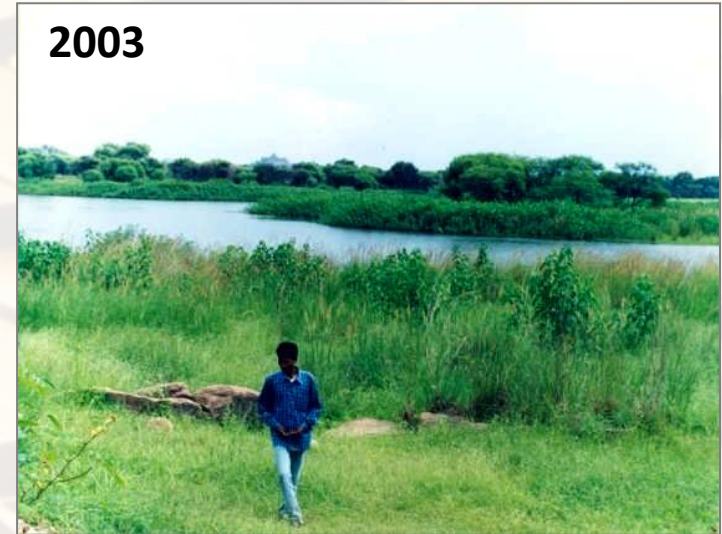
In 2009, Madhya Pradesh Government declared 37 out of total 50 districts as drought-hit in what was said to be the "worst drought of the century".

Impacts of Climate Change in Madhya Pradesh

LAND DEGRADATION

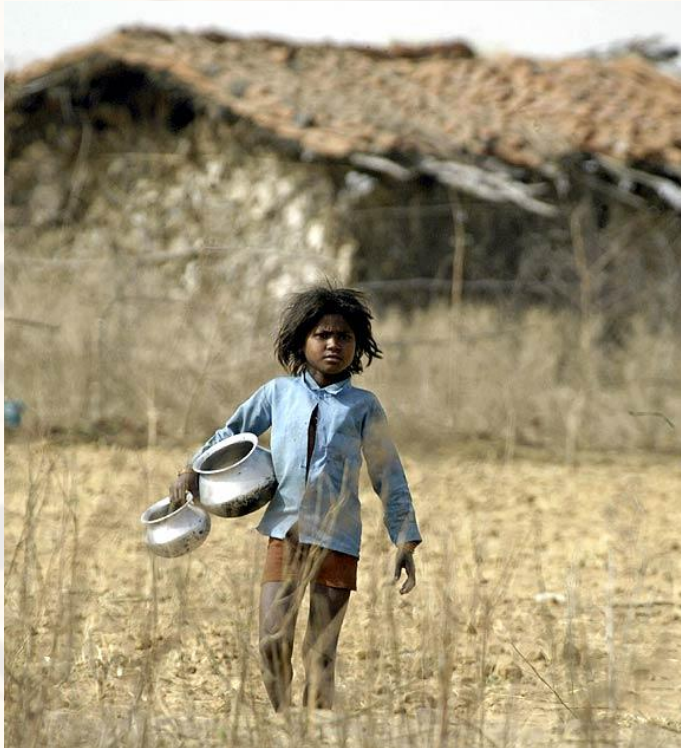
15,33,665 ha of degraded land recorded in Madhya Pradesh i.e. 27.46% of the land surveyed in districts of Balghat, Chattarpur, Gwalior, Jhabua, Morena, Ratlam, Sidhi.

-Land Degradation Mapping, Soil and Land Use Survey of India, 2007
Ministry of Agriculture, Govt. of India



Pond in Datia district

Impacts of Climate Change in Madhya Pradesh



PREDICTED CHANGE

- Higher maximum temperature
- Shifts in rainfall pattern

PROJECTED IMPACTS

- Acute shortage of water resources
- Increased incidence of drought
- Increased risk of forest fire
- Degraded soil cover
- Increased runoff in some river basins and water logging.

Factors Aggravating Climate Change in Madhya Pradesh

- Deforestation that removes natural carbon sinks and alters natural geographical buffers to climatic extremes
- Depletion of water resources that disturbs the groundwater hydrology.



- Detrimental methods of sourcing building materials like mining natural resources have been carried on unrestricted for years.

Many of these activities are carried out to support the needs of the construction activities within the state.

The Construction Sector

GLOBALLY, the construction sector :

- Accounts for 40% of the total flow of raw materials into the global economy every year.
- Contributes 9% of global Gross Domestic Product (GDP).



IN INDIA, the construction sector:

- Is amongst the fastest growing sectors today : 156% growth from 2000 to 2007, providing employment to 18 million people directly.
- Was estimated at 70.8 billion dollars in 2008-09, in a trillion dollar economy.
- Has been steadily contributing about 8% to the national GDP over the last 5 years.

How does Climate Change affect Construction?

Changed needs of habitat and shelter in response to climate change.



Water storage

Designing in water efficiency and capture

Uncomfortably hot or cold temperatures, high velocity winds and intense precipitation

Climate resilience in design and construction of buildings

Increased incidence of extreme weather events

Increased durability and performance

Flood and earthquake proneness of HP

Building designs and location

Generation of huge amounts of debris from damaged buildings

Appropriate disposal and reutilization of debris

How does Construction affect Climate Change?

Building construction and operation activities have extensive direct and indirect impacts on the environment.

At the national level, activities of the construction sector

22% of the total annual national CO₂ emissions (80% results mainly from production of energy intensive building materials - steel, cement, bricks and lime)

Deforestation and extraction of natural materials

Alteration of water cycle, land degradation, impact on local communities and impact on air quality.

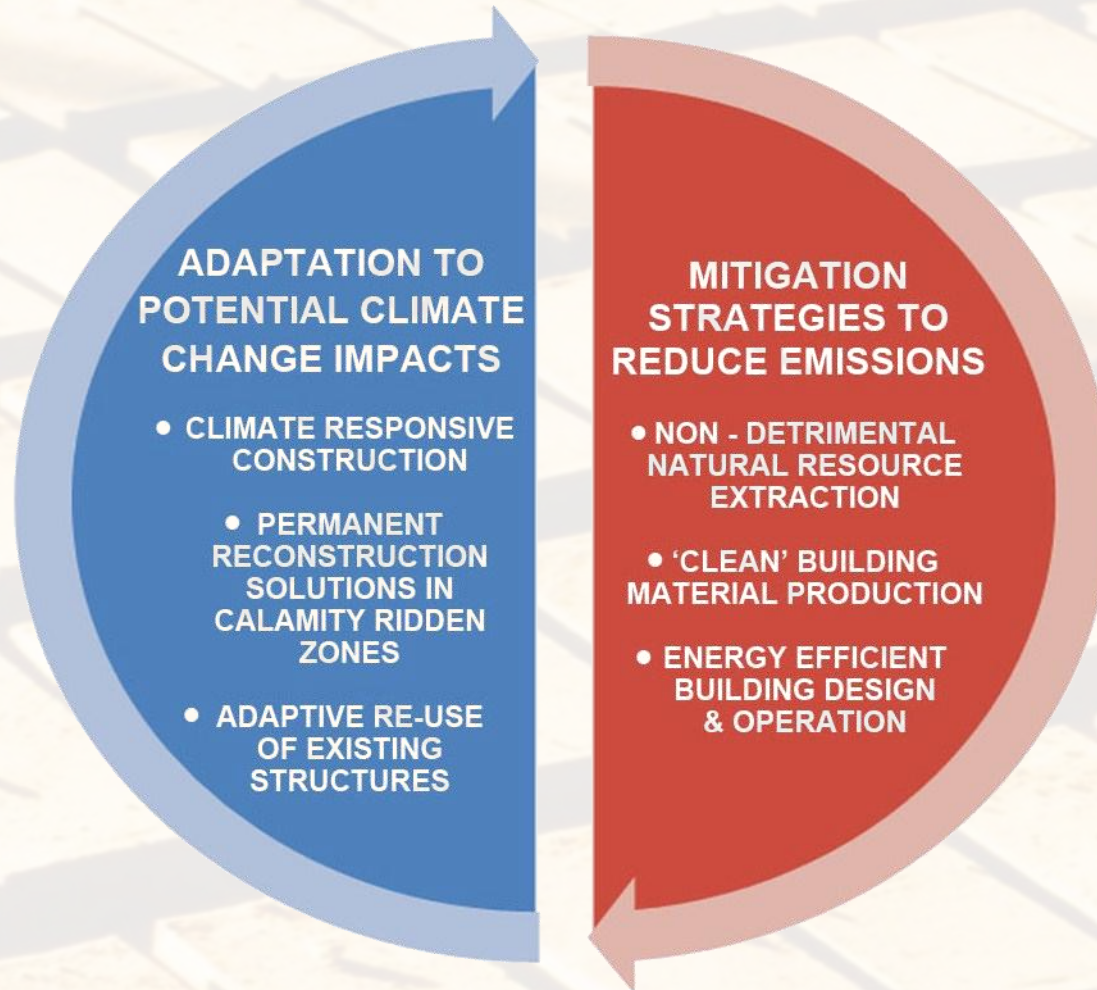
Operational energy needs of buildings contributes to peak in electricity consumption

Green house gas (GHG) emissions

Rapid increase in housing construction

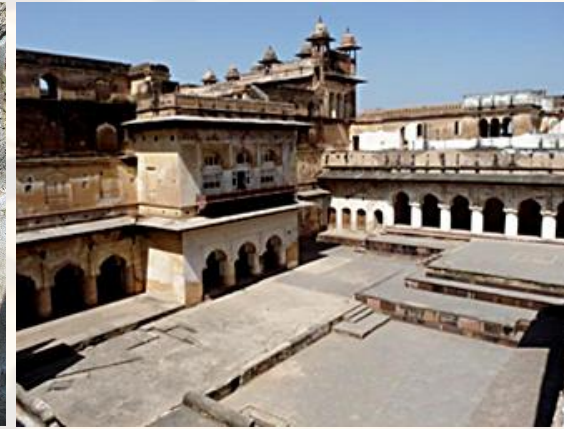
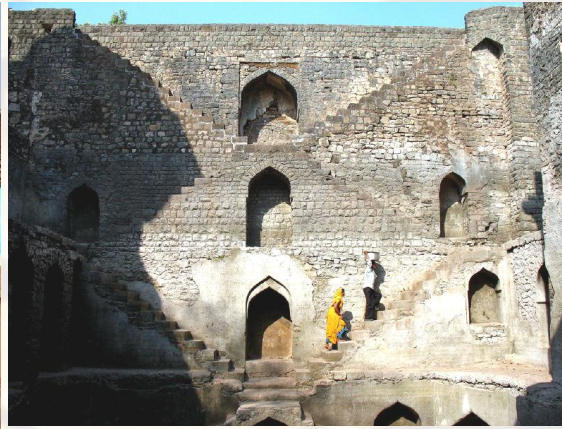
Intensifies pressures identified above

Construction and Climate Change: a cyclic link



Conventional Building Practice in Rural Madhya Pradesh

Rich tradition of building with stone and brick



BUILDING SYSTEMS USED:

- Burnt clay brick masonry (locally produced burnt clamp bricks) and sandstone slabs.
- Clamp burnt bricks and tiles placed overlapping on wooden under-structure is typically used for cheap construction.
- Locally fired clay tiles of low strength and durability known as 'khaprail' are used for sloping roofs.



Conventional Building Practice in Rural Madhya Pradesh

CHANGING BUILDING TRENDS

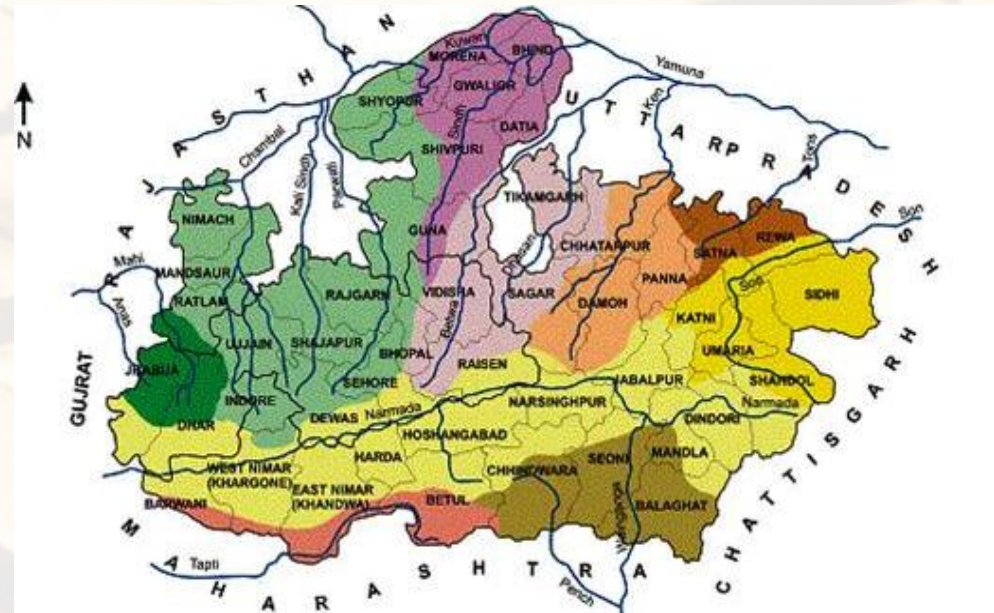


- Increased preference for RCC roofs in rural areas(though less thermally comfortable and frequently suffer from poor quality control).
- Sandstone slabs on steel girder for flat roofs.
- Random rubble masonry is the most common option for foundations because of stone being available in abundance.
- Water harvesting from roof-tops and surface run-off rain has largely not been adopted.

Resources in Madhya Pradesh

WATER RESOURCES

- 10 river basins originate in MP
- Tremendous ecological stress due to depletion of water resources.



GEOLOGICAL DISADVANTAGE

Underlying granite layer does not allow enough groundwater recharge. Hence, the region is dense with surface water harvesting structures or shallow dug wells.



Most drinking water sources-traditional, masonry wells & hand-pumps dried up between 2003-08.

Resources in Madhya Pradesh

WATER RESOURCES

“Only about 7% villages in Bundelkhand region have year round water availability.”

*-Report On Drought Mitigation Strategy for Bundelkhand region,
Inter-Ministerial Central Team(IMCT), 2008*



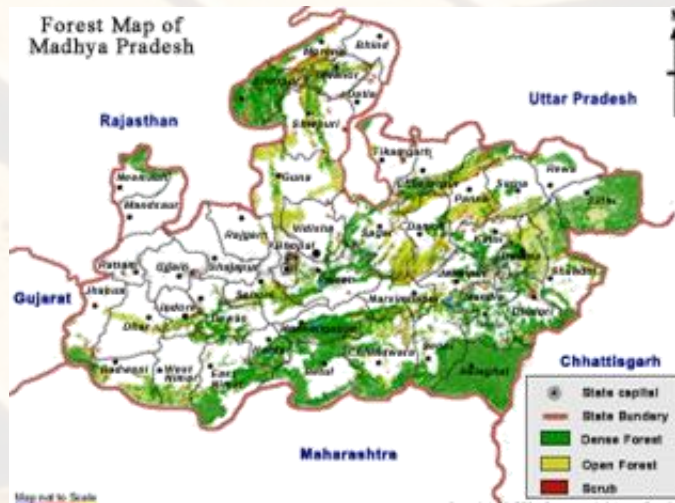
SHARP CONTRAST

Till the 1980s, the traditional wells in villages ensured enough drinking water for both humans and animals even during years with light monsoons.

Resources in Madhya Pradesh

FOREST RESOURCES

The natural resources in Madhya Pradesh have been severely impacted by extensive deforestation, over the last 50 years and the Forest survey of India suggests significant increase in deforestation, land and resource needs in the last decade.



“There was a recorded loss of forest cover of about 12 per cent (over 3500 sq. Km of forest area) in between 2001 to 2011.”

State of Forest Report
Forest Survey of India, 2001-2011

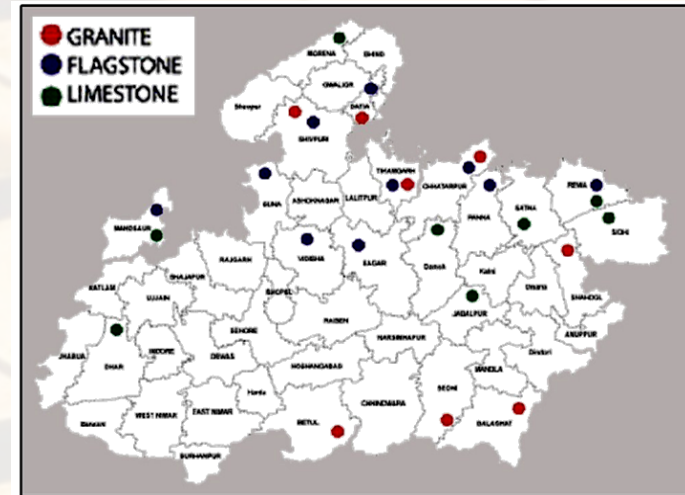
Resources in Madhya Pradesh

MINERAL RESOURCES

Madhya Pradesh is the second richest state in mineral resources.

Quarried stones:

- Multi-coloured granite
- Flagstone (major building stone)
- Limestone (major consumer - cement industry)



Resources in Madhya Pradesh

RE-USABLE INDUSTRIAL WASTE

CEMENT PLANTS
(leading producer of cement in the country)
• 7 major plants
• 21 new plants to be set up.

POWER PLANTS
• 5 major power plants (installed capacity of $\approx 8,000$ MW)
• Many more upcoming projects

STONE CRUSHERS
• 35 cutting and polishing industries

Tonnes of fly-ash as waste : huge potential for its re-utilization in building materials.

Stone dust :
alternative to coarse sand in construction activity.



Pressures of Extracting & Processing Building Materials in Madhya Pradesh

Increase in the use of stone crushers

Dumping of stone dust on agricultural land, thereby converting it rapidly into wasteland. Suspended particulate matter (SPM) cause of concern for health and human well-being.

Deforestation & neglect of traditional water harvesting systems of tanks and ponds,

Loss of carbon sinks, irregular water flow (drying up of natural springs and increased vulnerability to droughts).

The extraction and processing of mineral resources

Loss of forest cover, accelerated erosion, silting of water bodies, air and water pollution

Construction of big power projects, roads and buildings

The dust, smoke and silt coming out of these plants are heavy sources of pollution.

Cement is one of the biggest industries

Large scale destruction of natural resources with open cast mining of limestone.

Thank you

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