

Pakistan Experiences on adopting Green, Sustainable and Socially inclusive Transport Infra-Structure

Presentation by
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National Highway Authority



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- ▶ Introduction of National Highway Authority
- ▶ Pakistan and Climate Change
- ▶ Post Flood Disasters Damages of NHA Infrastructure
 - ▶ Rehabilitation projects of 2010 Flood:FERP & PNHRP
- ▶ Damage Need Assessment 2022 Flood
- ▶ Post Flood Disaster Initiatives
- ▶ Challenges towards a Resilient Road Infrastructure
- ▶ National Highways & Green infrastructure
- ▶ Lessons learned & Recommendations
- ▶ Conclusions



NATIONAL HIGHWAY AUTHORITY (NHA)

- ▶ National Highway Authority (NHA) is responsible for maintenance and operation of
- ▶ 44 x national highways,
- ▶ 12 x motorways,
- ▶ 4 x strategic roads
- ▶ 1 x expressway
- ▶ having total length of approximately 14,520 km.

GOVERNMENT OF PAKISTAN MINISTRY OF COMMUNICATIONS MAP OF NATIONAL HIGHWAY NETWORK

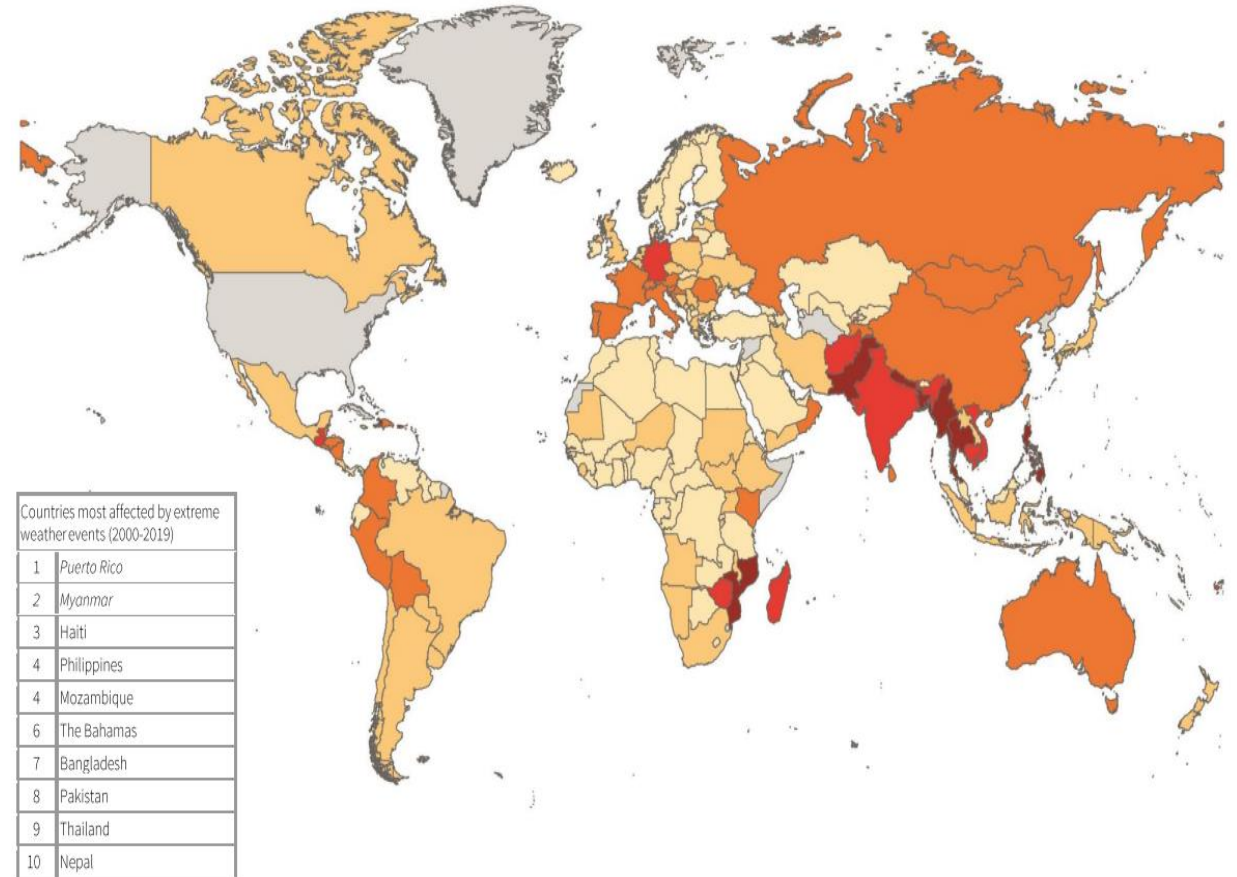


Pakistan and Climate Change

- ▶ Pakistan and Climate Change
 - Pakistan Ranking Climate change index - 2021 report
 - Report of UNCCD :This year Pakistan was enlisted by UN among 23 countries facing drought emergencies for the last two years
 - Extreme Climate change induced flooding in Pakistan
 - Heat wave & warming effect
 - GLOF melting
 - Arabian Sea & Indian ocean warming
 - Westerlies wave, Cloud bursts, heavy monsoon rainfall
- ▶ NHA and Climate impacts
 - ▶ Major Flood disasters 2010 & 2022
 - ▶ Road Infrastructure damages
 - ▶ Social Impacts
 - ▶ Financial impacts

Figure 1: World Map of the Global Climate Risk Index 2000 – 2019

Source: Germanwatch and Munich Re NatCatSERVICE



Italics: Countries where more than 90% of the losses or deaths occurred in one year or event

Climate Risk Index: Ranking 2000 - 2019

1 - 10 11 - 20 21 - 50 51 - 100 >100 No data



Post Flood Disasters Damages of NHA Infrastructure

- ▶ During 2010 Floods, approximately 700 km road network along with 48 bridges were damaged.
- ▶ NHA initiated **Flood Emergency Reconstruction Project (FERP)** with the financial assistance of Asian Development Bank (ADB) through 19 projects addressing length of 340 km.
- ▶ **Institutional arrangement:** A Project specific Management Unit (PMU) was established in NHA-HQ for FERP management headed by GM FERP as a Focal Person. Environmental & Social Unit (ESU) led by In charge-ESU to fulfill Pakistan national legal requirements and comply with ADB safeguard policies. All safeguards requirements were duly fulfilled including REA, IEE, EIA and LARP on project to project basis.
- ▶ **Post Flood National Highway Reconstruction Project (PNHRP):** It is also known as FERP 2. It was an Extension of FERP, with length of 203 Km.



PNHRP 2017 to 2022

Post Flood National Highways Rehabilitation Project (PNHRP)

Bahrain - Chinggarh (P-1 L-1)
Km. 97+310 - 108+675 (11.365 km)

Chinggarh - Asrit (P-1 L-2)
Km. 108+675 - 117+250 (8.575 km)

Asrit - Pashmal (P-1 L-3)
Km. 117+250 - 125+800 (8.550 km)

Pashmal - Kalam (P-1 L-4)
Km. 125+800 - 132+675 (6.875 km)

Chakdara - Bahrain (Bridge Package)
Km. 00 - 106 (10 New Bridges)(P-2 L-1)

Darazinda - Daraban (P-4 L-1)
Km. 447 - 457+68 (10.68 km)

Dhanasar - Sheikhmela (P-8 L-1)
Km. 395+353 - 426 (30.65 km)

Bahrain - Kalam (Bridge Package)
Km. 106 - 134 (12 New Bridges)
(P-2 L-2)

Naran - Batakundi (P-3 L-1)
Km. 123 - 139+21 (16.21 km)

Batakundi - Jalkhad (P-3 L-2)
Km. 139+21 - 161+89 (22.68 km)

Sara-i-Gambila - Peshawar (P-5
Km. 1032 - 1228 (19 km) L-2)

D.I. Khan - Sara-i-Gambila (P-5
Km. 932 - 1032 (20 km) L-1)

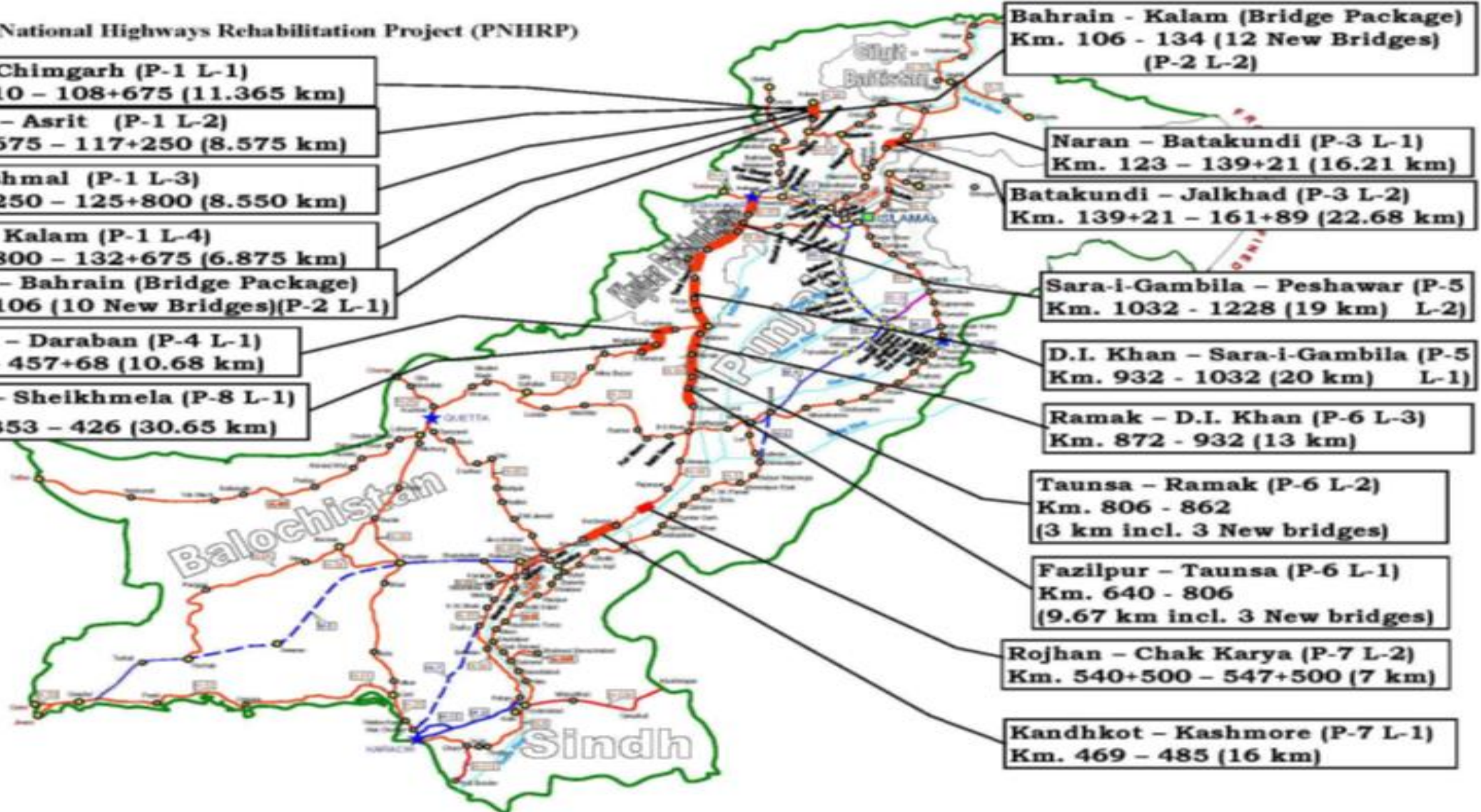
Ramak - D.I. Khan (P-6 L-3)
Km. 872 - 932 (13 km)

Taunsa - Ramak (P-6 L-2)
Km. 806 - 862
(3 km incl. 3 New bridges)

Fazilpur - Taunsa (P-6 L-1)
Km. 640 - 806
(9.67 km incl. 3 New bridges)

Rojhan - Chak Karya (P-7 L-2)
Km. 540+500 - 547+500 (7 km)

Kandhkot - Kashmore (P-7 L-1)
Km. 469 - 485 (16 km)





Post Flood Damage Need Assessment 2022

- ▶ Approximately, 497 km road network, 17.6 km long retaining structures , 29 Culverts and 46 bridges were completely/partially damaged.
- ▶ As per Damage Need Assessment (DNA) 2022 the estimated cost of Rehabilitation is approx. Rs. **78.27 billion**.
- ▶ NHA is acquiring emergency loan from ADB amounting to US Dollar 164 million for Rehabilitation 86 km long National highway N-5 between Sukkur - Hyderabad.

Province	Road Damaged Length (Kms)		Retaining structures km	Culverts	Bridges	Total Amount Rs.
Balochistan	26.46	74.67	7.2	14	21	16.27
Sindh	173.43	143.66	0.4	-	9	38.22
KPK	21.27	37.64	9.2	-	14	21.00
Punjab	0.08	20.68	0.2	15	1	1.94
Gilgit Baltistan	0.80	-	0.6	-	1	0.85
						78.27 billion

NHA Network - Punjab Flood Damages 2022 Location Map

Punjab NHA Road Network Details

S.No	Route	Section	Length (KM)
1	N-5	Kot sabzal -Attock	1,022
2	N-5A	Khanewal - Lodhran	102
3	N-55	Kashmore-Ramak	373
4	N-70	Multan -Bewata	181
5	N-80	Tarnol - Khushalgarh	108
6	N-115	Jalalpur Peer Wala Bypass	8
7	N-130	Balkasar - Mianwali	129
8	N-135	Mianwali - Muzaffargarh	279
9	M-1	Islamabad-Attock	65
10		Lahore - Islamabad	350
11	M-2	M-2 Link Islamabad	9
12		M-2 Link Kalashah Kaku	8
13		Neela Dulha - Mangwal Road	22
14	M-3	Abdul Hakeem - Lahore	229
15	M-4	Multan-Pindi Bhattian	295
16	M-5	Sadiqabad - Multan	212
17	LSM	Lahore - Sialkot	91
18	LEBP	Lahore Eastern Bypass	19
19	M-14	Hakla - Mianwali	228
20		Head Muhammad Wala Bridge & Approaches	11
21		Sultan Bahu Bridge & Approaches	8
22		Chand Bridge & Approach Roads	6
23		Talib Wala Bridge & Approach Roads	19
Total Length			3,774



1:4,200,000

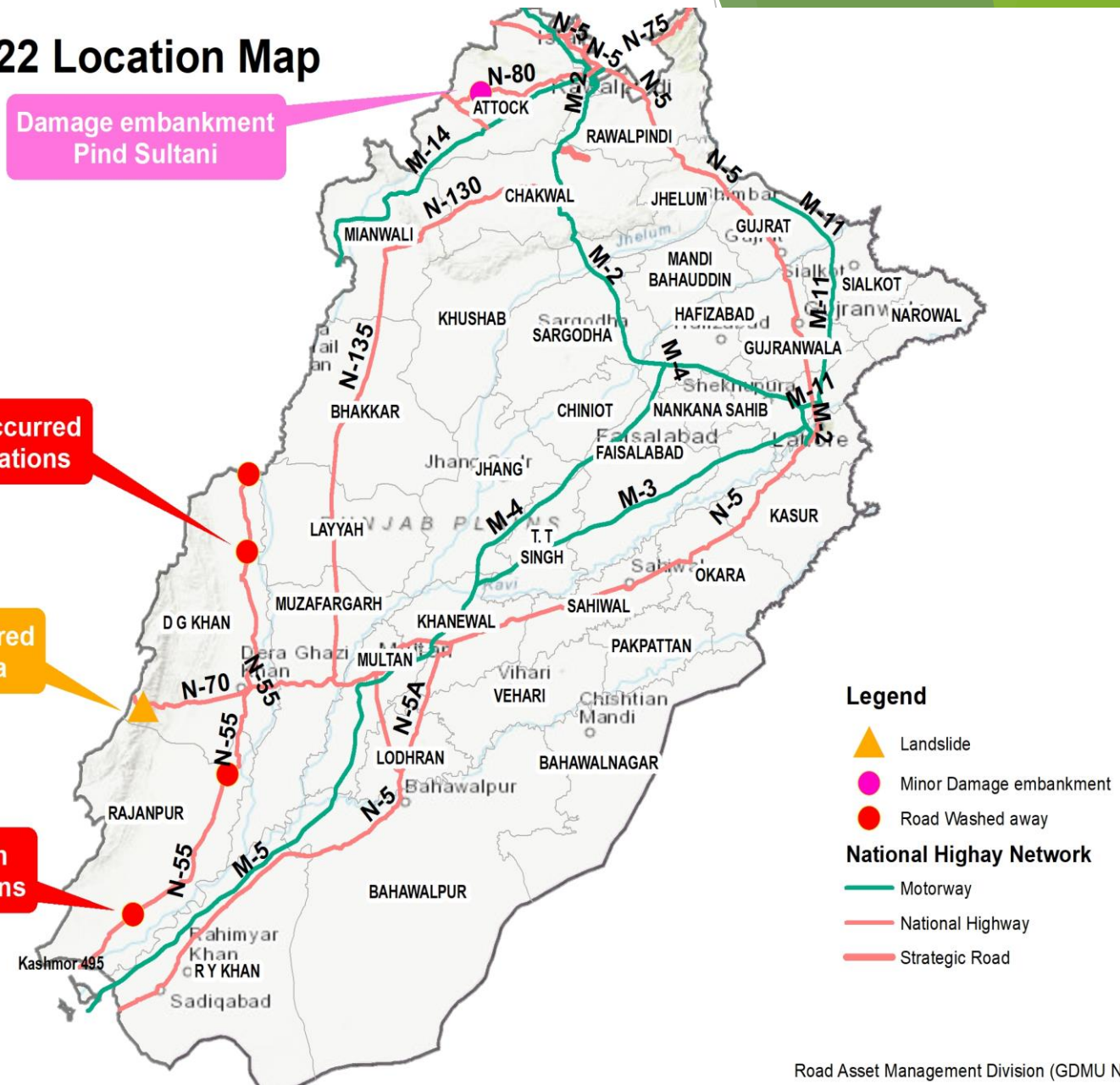
0 100 200 Km

Damage embankment
Pind Sultani

Breaches occurred
various locations

Landslides occurred
Fort Munro area

Fazilpur – Rajanpur Section
Road breached at 2 locations



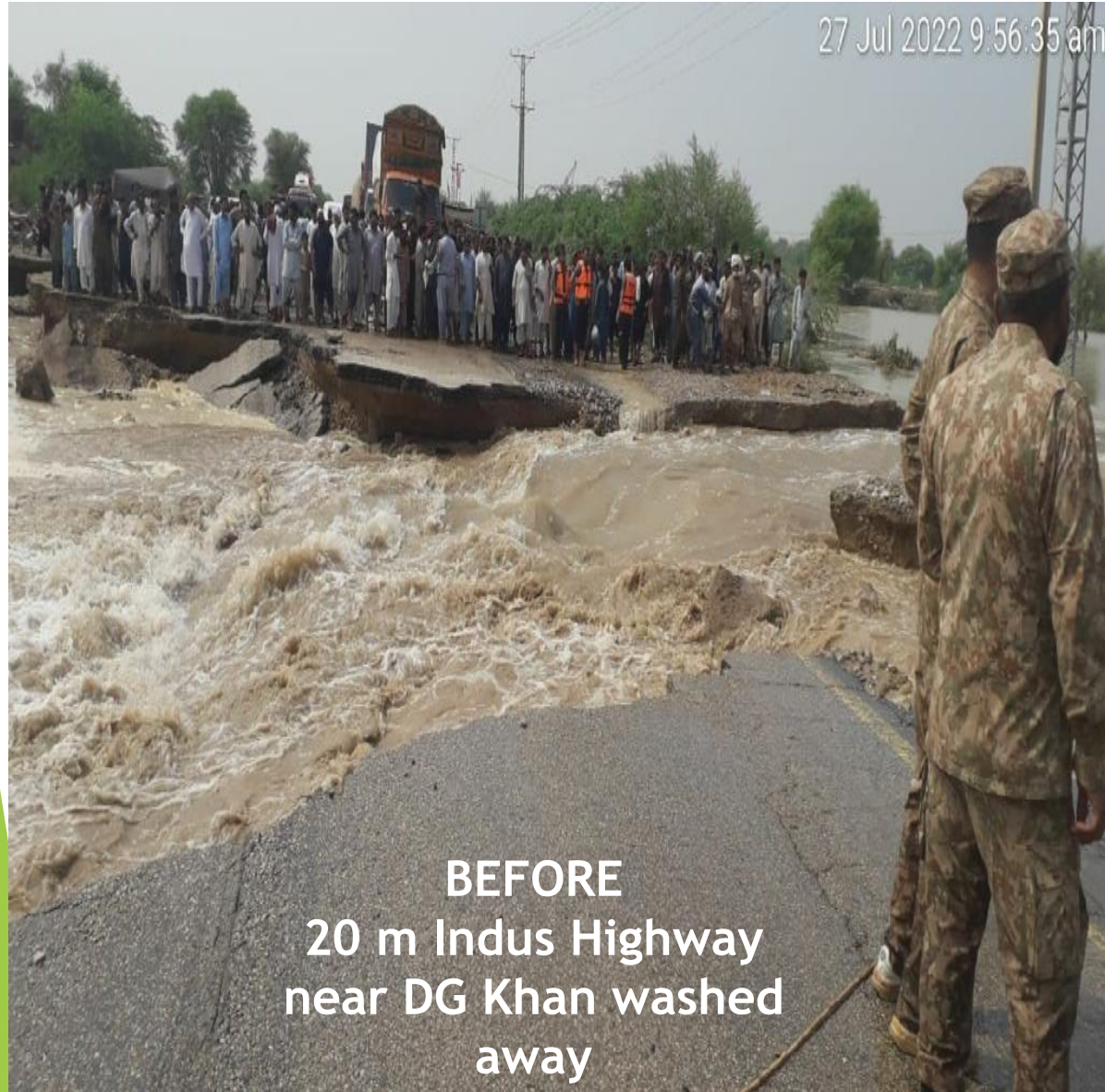
Legend

- ▲ Landslide
- Minor Damage embankment
- Road Washed away

National Highway Network

- Motorway
- National Highway
- Strategic Road

Rain / Flood Damages - Punjab



N-55 (Fazilpur – Rajanpur KM 539 -540)



Landslide Fort Munro (N-70)



NHA Network - Sindh Flood Damages 2022 Location Map

Sindh NHA Road Network Details

S.No	Route	Section	Length (KM)
1	N-5	Hyderabad - Sukkur-Kot Sabzal	455
2	N-5 KTHH	Karachi - Hyderabad	158
3	N-20	Dera More(N-55) - Guddu Barrage-Chowk Mari (N-5)	42
4	N-25	Karachi - Hub Chowki	37
5	N-55	Kotri -Dadu- Kashmore	495
6	N-65	Sukkur - Dera Allah Yar	109
7	N-105	Larkana - Naudero - Lakhi	61
8	N-110	Gharo - Ketri Bander	90
9	N-120	Mirpur Khas - Khokhrapar	159
10	N-155	Larkana - Moenjodaro	28
11	N-255	Larkana - Nasirabad	34
12	N-305	Sakrand - Shaheed Benazirabad	35
13	N-455	Larkana - Kambar - Shahdadkot	50
14	N-655	Ratodero - Naudero	18
15	M-5	Sadiqabad - Rohri	180
16	M-6	Hyderabad - Rohri (Under Construction)	306
17	M-8	Ratodero - Qubo Saeed Khan	64
18	M-9	Karachi - Hyderabad	136
19	M-10	Karachi Northern Bypass	56
20		Liyari Expressway	17
Total Length			2,530

Legend

- Road Washed away
- Inundation Location
- Motorway
- National Highway/Strategic Road
- Flood Extent Sep 2, 2022

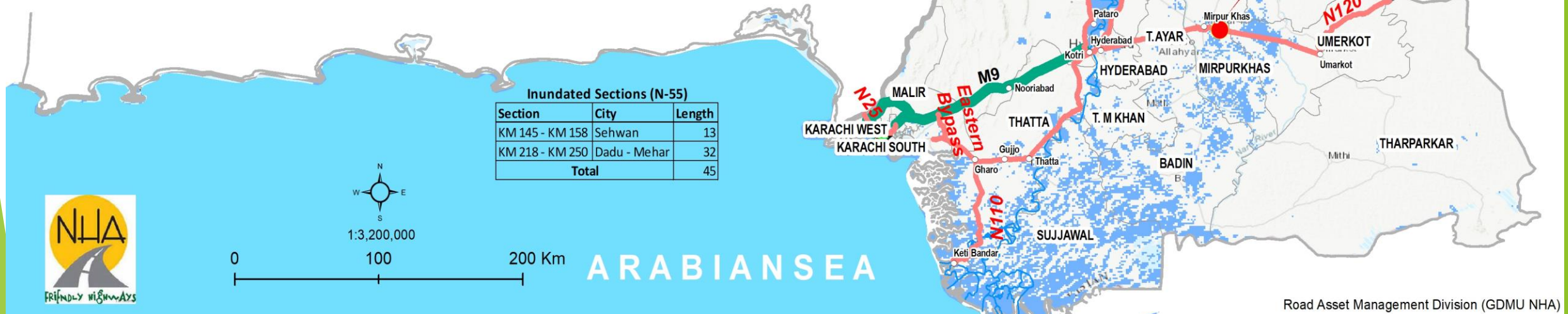
Inundated Sections (N-55)

Section	City	Length
KM 145 - KM 158	Sehwan	13
KM 218 - KM 250	Dadu - Mehar	32
Total		45

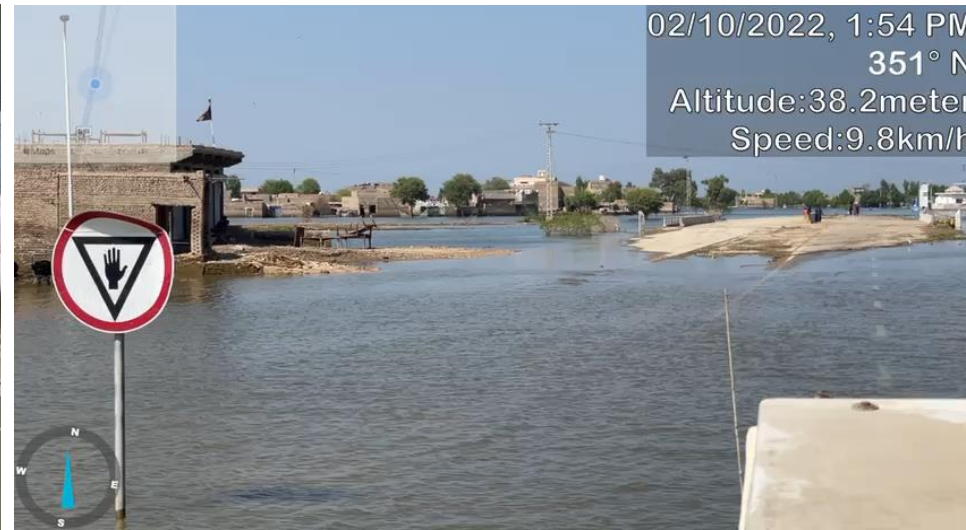
Water accumulation
minor damages, etc.

Minor damages

Road section
breached (30 m)



Inundation on N-55 (Khairpur Nathan Shah – Mehar)



NHA Network - Balochistan Flood Damages 2022

Location Map

Legend

- Bridge Collapse
- ▲ Landslide
- Motorway (Operational)
- - Motorway (Planned)
- National Highway/Strategic Road

Map Labels:

- N-25 (KM 790+790) bridge damaged
- Approach of Abad bridge damaged
- Yak Mach - Kharan Under Construction
- M-8: (KM 100 – 140) Land sliding occurred in 24 Km Length
- N-25 (KM 22 - 292) Bridge Collapse in Multiple Locations
- Bibi Nani
- Pinjra Bridge 8 km road

Geographical Labels: IRAN, BALUCHISTAN, WASHUK, KHARAN, KHALAT, KHUZDAR, AWARAN, KECH, GWADAR, LASBELA, JAFFARABAD, SOHBATPUR, DERA BUGH, LEHRI, KACHHI, SIBI, HARNAI, ZIARAT, KILLA SAIFULLAH, KILLA ABDULLAH, PISHIN, ZHOB, SHEERANI, MUSAKHEL, BARKHAN, LORALAI, N-50, N-70, N-65, N-40, N-30, N-85, N-10, M-8, M-8 Under Planning.

Scale: 1:4,590,000

Scale Bar: 0 100 200 Km

S.No	Route
1	N-10
2	N-25
3	N-30
4	N-40
5	N-50
6	N-65
7	N-70
8	N-85
9	
10	
11	M-8



S.No	Route	Section	Length (KM)
1	N-10	Uthal - Gwadar - Rimdan Border	581
2		Jiwani Road	30
3	N-25	Hub-Quetta-Chaman	784
4	N-30	Khuzdar - Basima	110
5	N-40	Lakpass-Taftan	605
6	N-50	Kuchlak - Dhanasar	378
7	N-65	Dera Allah Yar - Quetta	284
8	N-70	Bewata - Qila Saifullah	266
9	N-85	Hosab - Panjgur- Sorab	448
10		Yakamach - Kharan	198
11	M-8	Khuzdar - Qubo Saeed Khan	172
		Gwadar - Hoshab	202
Total Length			4,058

Road Damage M-8 (KM 127-140)



Landside Wangu Hills M-8 (KM 110-111)



Road Damage N-65 (KM 235)



Carriageway Breached Opposite to Gate 2 DG Cement



Jul 25, 2022 at 12:14:25
Balochistan South
National Highway Authority

Hub River Bridge (N-25)



N-35 (KM 303, 126 & 268) Bridge Collapse



N-35: (KM 608 – 646)
Land sliding occurred

N-35: (KM 288 – 336)
Land sliding occurred

N-15 (KM 118, 126 & 157) Bridge Collapse

N-50 Sagu Bridge Collapse

N-55 (KM 508 - 512) Flash Flood

**N-50 (KM 480 - 481)
Road was Breached**

INDIAN ILLEGALLY OCCUPIED JAMMU & KASHMIR
(DISPUTED TERRITORY - FINAL STATUS TO BE DECIDED
IN LINE WITH RELEVANT UNSC RESOLUTIONS)



1:3,900,000

S.No	Route	Section	Length (Km)
1	N-15	Babu Sar - Chilas	47
2	N-35	Sazin-Khunjrab	456
3	N-140	Gilgit - Shandur	216
4	S-1	Jaglot - Skardu	167
Total Length			886

S.No	Route	Section	Length (KM)
1	N-15	Mansehra - Babu Sar	187
2	N-35	Hassanabadal-sazin	350
3	N-125	Taxila - Haripur	44
4	E-35	Burhan- Battgram	161
Total Length			742

S.No	Route	Section	Length (KM)
1	N-5	Khairabad - Torkham	126
2	N-45	Nowshera-Chitral	313
3	N-50	Dhanasar - D.I. Khan	152
4	N-55	Ramak - Peshawar Old Bannu Road	342 127
5	N-80	Kushalgarh - Kohat	42
6	N-90	Khwazakhela - Besham	64
7	N-95	Chakdara - Kalam	134
8	PNBP	Peshawar Northern Bypass	31
9	N-140	Shandur - Chitral	148
10	N-145	Chitral-Garam Chashma-Doraha Pass Road	83
11	M-1	Attock - Peshawar	89
12	M-14	Wanda Baru - Yarik	63
Total Length			1,714

Road Asset Management Division (GDMU NHA)

N-15 at Battal



Rain / Flood Damages - KP

N-15



N-35, Km. 303, Dasu





Post Flood Disaster Initiatives

- ▶ **Built Back Better Approach** to improve and construct sustainable & resilient infrastructure.
- ▶ **Relief- Rehabilitation - Reconstruction and Resilient**
- ▶ NHA developed Post Flood Rehabilitation Plans with completion target around 2024 & 2025.
 - ▶ **Short Term plans: Emergency Restoration**
 - ▶ Reconstruction of 32 Bridges,
 - ▶ Rehabilitation of 86 Km long National Highway N-5 (Ranipur - Moro)
 - ▶ **Medium Term plans: Rehabilitation & Reconstruction**
 - ▶ Rehabilitation of bridges and 396 km damaged road sections
 - ▶ **Long Term plans: Resilient Infrastructure**
 - ▶ Rehabilitation widening and improvement of priority sections of N-5 (Sukkur - Peshawar)



Challenges in a Resilient Road Infrastructure

- ▶ **Pre-Disaster Vulnerability gap**
- ▶ **Post-Disaster Vulnerability gap**
- ▶ ***Vulnerability of Road infrastructure***
 - ▶ Natural causes (Climate)
 - ▶ Human induced causes (Encroachments in water ways)
 - ▶ Social causes (post disasters)
- ▶ **Lesson learned:**
 - ▶ Modification of Engineering Designs and Structures
 - ▶ Study of Hydrology & use of Existing tools - GIS models
 - ▶ Additional measures for vulnerability reduction
- ▶ **Recommendations**
 - ▶ Integrated approach for disaster management
 - ▶ Prompt information sharing to and from NHA
 - ▶ Identification of flood vulnerable areas and with appropriate preparedness



Green infrastructure Approach in National Highways

Green Infrastructure Approach to create Sustainable highways having diverse capabilities .Plantation along highways Motorways and slope stabilization is an important part of it.

► **Past Practices:**

- Green Pakistan 2009
- Slope stabilization on EQDR
- IMDCW project Slope stability by Bio-engineering
- Clean & Green Pakistan Campaign & Billion Tree tsunamis Plantation program

► **Current:** Plantation work is outsourced. MOUs signed with private sectors for plantation and maintenance for 3 years

► **Future initiatives:** Rain water Harvesting-Clean energy use, and Pilot Project on drip irrigation method in drought areas.

► **Future Strategies and policies:** Based upon topography a comprehensive study is needed for planation in various geographic areas of Pakistan along National Highways and Motorways. Study would serve as basis of Green infrastructure. Slope stabilization requirements and methods may also be identified in this process.

- For Better Resource Circulation: Careful Selection of species which are good source of return as well, Olives , orchards, Drought resistant species etc





Conclusion

- ▶ For Green and Resilient infrastructure
 - ▶ Policies design, Strategies and Action Plans
 - ▶ Ensuring measures to achieve green infrastructure
 - ▶ Redesigning of infrastructure based on comprehensive Hydraulic Study
 - ▶ Institutional strengthening & Capacity Development
 - ▶ Post Disaster Cell 3 (Rescue relief & restoration)
 - ▶ Climate change & Green Cell (Green Resilient infrastructure)

- ▶ Financial implications are at large
 - ▶ Funding and Donations other than technical resource

Thank You