

# Siksha Swaroopa Kar      शिक्षा स्वरूपा कर

Senior Scientist, CSIR-Central Road Research Institute, New Delhi-110025  
Assistant Professor, Academy of Scientific and Industrial Research, India

## Research Interest

Pavement Material and its Characterization, Carbon Efficient Pavement Construction Technologies, Environmental Related Issues in Highway Projects, Innovative Materials and Technologies in Pavement Engineering

## Education

**Doctor of Philosophy in Engineering Science**, 2018, Academy of Scientific and Industrial Research, India

**Master of Technology in Material Resource Engineering**, 2012, CSIR-Institute of Minerals and Materials Technology, Odisha, India.

**Bachelor of Technology**, 2010, Indira Gandhi Institute of Technology, Sarang, Odisha, India.

## Experience

**Senior Scientist**, CSIR-Central Road Research Institute, December 2015 to till date

**Scientist**, CSIR-Central Road Research Institute, March 2013- December 2015

**Scientist**, CSIR-Institute of Minerals and Materials Technology, December, 2012-March 2013

**Quick Hire Scientist Fellow**, CSIR-Institute of Minerals and Materials Technology, August 2018- December, 2012

## Publications: Annexure I

Journal:	19	Articles:	3
Conference Proceedings:	30	Hindi Articles:	3
Research Reports:	About 10 reports prepared related to sponsored research and consultancy projects		

### Patents: Annexure II

	Filed	Grant
Patents	4	-

### Student Guided: Annexure III

	Ongoing	Completed
Doctor of Philosophy	1	-
Master of Technology	3	5
Bachelor of Technology	-	3

### Projects: Annexure IV

	As Principal Investigator	As Team Member
CSIR-CRRI In house R&D	5	4
Government Aided	3	2
Sponsored R&D	7	6
Consultancy	6	12
Technical Services	4	1

### Professional Memberships

Life Member, Indian Roads Congress

Life Member, Indian Geotechnical Society

Life Member, Indian Society of Chemical Engineering,

### Participation and Awards in Hindi Pakhwada Divas

Consolation prize for the **Technical Paper Writing in Hindi**, at Hindi Pakhwada Divas 2019.

Consolation prize for the **Technical Paper Writing in Hindi**, at Hindi Pakhwada Divas 2018.

Consolation prize for **Hindi Essay Writing** at Hindi Pakhwada Divas 2018.

2nd Prize for the **Technical Paper Writing in Hindi**. at Hindi Pakhwada Divas 2017.

## Awards & Honours

**Fellowship by Earthwatch Institute Collaboration with Green Highways, NHA** on 'Beat the Plastic Pollution through Innovative Ideas' and 'Greening of Highways' Initiatives. (July 2019 -December2020)

**CSIR-Technology Award** 2017 for the topic "Sustainable Cold Mix Technology for Construction and Maintenance of Roads" under "Physical Sciences including Engineering" category on 26<sup>th</sup> September 2017

**Appreciation Certificate and momento**, CSIR-CRRI as "Inventor of Patch Fill- A Solution for Pothole Repair" on Technology Transfer Day of Setu Care and PatchFill, 5th Dec 15

**Best Poster Award** at Conference on Sustainable Asphalt Pavement for Developing Countries , CSIR-CRRI, Delhi, 11-12th March 16 for the paper "Improvement of Durability of Hot Mix Asphalt by Chromium Containing Solid Wastes from Leather Industry"

**Quick Hire Scientist (QHS)-Trainee fellowship** under the QHS scheme of the Council of Scientific and Industrial Research (CSIR), India (2010-2012)

## Official Responsibilities

Member of Library Committee, CSIR-CRRI, 2013 till date

Representative from CRRI in Workshop cum Demonstration of "Cold Mix Technology" for disseminations of technology, organized by State Govt Road Agencies & NRIDA (2015 to till date)

Member in the committee constituted for extension of technology transferred document of "Cold mix technology", CSIR-CRRI, 2018

Member of event management committee for organizing two day conference "International Conference on Pavements and Computational Approaches" on 16-17<sup>th</sup> November, 2018, CSIR-CRRI, Delhi

Co-champion for venue arrangement for organizing of two days conference “Conference on Sustainable Asphalt Pavement for Developing Countries” on 11th -12th March 2016. CSIR-CRRI, Delhi

Member of Management Council, CSIR-CRRI, 2015-16

Task force member for ISO audit for Flexible Pavement Division, CSIR-CRRI, 2013 - 2016

### Participation in Training & Workshop

International Course on Dissemination of HDM4, organised by CSIR-CRRI, Delhi, from 26<sup>th</sup> November to 7<sup>th</sup> December, 2018

National Workshop on "Standardization for Building Green & Resilient Road Infrastructure held on 21st April, 2018 at New Delhi, organised by IRC G3 Committee

Workshop on ‘Life Cycle Assessment of Hot Mix & Cold Mix Technologies for Construction and Maintenance of Rural Roads’ on 18-Aug-2017 at India International Centre, New Delhi, organised by NRIDA, Delhi and World Bank,

Induction Training Programme of Scientist, organized by CSIR-HRDC, Ghaziabad, New Delhi, from 27<sup>th</sup> Jan 2013 to 5<sup>th</sup> Feb 2013

### Contact Details

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### **Journal**

Kar, S. S., Nagabhushana, M. N., & Jain, P. K. (2019). Performance of hot bituminous mixes admixed with blended synthetic fibers. *International Journal of Pavement Research and Technology*, 12(4), 370-379. (<https://link.springer.com/article/10.1007/s42947-019-0044-x>)

Eleyedath, A., **Kar, S.S.**, and Swamy, A.K. (2019) "Modelling of Expansion Ratio and Half-life of Foamed Bitumen using Gene Expression Programming." *International Journal of Pavement Engineering*. (<https://www.tandfonline.com/doi/abs/10.1080/10298436.2019.1609675?journalCode=gpav20>)

**Kar, S.S.**, Swamy, A.K., Tiwari, D., and Jain, P.K. (2018). "Impact of Low Viscosity Grade Bitumen on Foaming Characteristics." *Journal of the South African Institution of Civil Engineering*, 60(2). 40-52. (<http://www.scielo.org.za/pdf/jsaice/v60n2/05.pdf>)

Behl, A., Kar, S. S., Nagabhushana, M. N., Chandra, S., & Shukla, M. (2018). Application of Foam Bitumen in Asphalt Pavement Recycling: A Case Study. In *Journal of the Indian Roads Congress 79*, (2). (<https://trid.trb.org/view/1568545>)

**Kar, S.S.**, Swamy, A.K., Tiwari, D., and Jain, P.K. (2018). "Impact of Recycled Asphalt Pavements on Properties of Foamed Bituminous Mixtures." *Baltic Journal of Road and Bridge Engineering*, 13(1), 14-22. (<https://bjrbe-journals.rtu.lv/article/view/bjrbe.2018.383>)

Kar, S. S., Solanki, R., Kumar, G., & Jain, P. K. (2017). Modified asphalt-based crack and joint repair system. *Proceedings of the Institution of Civil Engineers-Construction Materials*, 170(5), 244-249. (<https://www.icevirtuallibrary.com/doi/full/10.1680/jcoma.16.00057>)

Kar, S. S., Behl, A., & Shukl, A. (2017). Green House Gases (GHG) Impact Assessment Tools: A Review. *Indian Highways*, 45(3), 19-27. ([https://www.researchgate.net/publication/315684512\\_Green\\_House\\_Gases\\_GHG\\_Impact\\_Assessment\\_Tools\\_A\\_Review](https://www.researchgate.net/publication/315684512_Green_House_Gases_GHG_Impact_Assessment_Tools_A_Review))

Kar, S. S., Swamy, A. K., Tiwari, D., & Jain, P. K. (2017). A CRITICAL, REVIEW ON FOAMI AND EMIULSION BASED COLD RECYCLED ASPHALT MIXES. *Indian Highways*, 45(8). 23-32 (<https://trid.trb.org/view/1486029>)

**Kar, S.S.**, Swamy, A.K., Tiwari, D., and Jain, P.K. (2017). "Impact of Binder on Foamed Bituminous Mixtures Properties." *Proceedings of Institution of Civil Engineers: Construction Materials*, 170(4), 194-204. (<https://www.icevirtuallibrary.com/doi/abs/10.1680/jcoma.16.00037>)

**Kar, S.S.,** Jain, P.K, and Swamy, A.K., Tiwari, D. (2017). "Study on Effect of Viscosity of Foaming Characteristics and Stabilized Mix Properties." *The International Journal of Pavement Engineering & Asphalt Technology*, 18(1), 11-30. DOI:10.1515/ijpeat-2016-0009, ([https://www.researchgate.net/publication/323005815\\_STUDY\\_ON\\_EFFECT\\_OF\\_VISCO\\_SITY\\_ON\\_FOAMING\\_CHARACTERISTICS\\_AND\\_STABILIZED\\_MIX\\_PROPERTIES](https://www.researchgate.net/publication/323005815_STUDY_ON_EFFECT_OF_VISCO_SITY_ON_FOAMING_CHARACTERISTICS_AND_STABILIZED_MIX_PROPERTIES))

**Kar, S.S.,** Swamy, A.K., Tiwari, D., and Jain, P.K. (2017). "A Critical Review on Foam and Emulsion Based Cold Recycled Asphalt Mixes." *Indian Highways*, 45(8), 23-32. (<https://trid.trb.org/view/1486029>)

Kar, S. S., Jain, P. K., & Sekaran, G. (2016). FTIR Analysis of Aging of Binder Modified with Chromium Waste Generated from Leather Industry. *i-Manager's Journal on Material Science*, 4(2), 24. (<https://search.proquest.com/openview/efa2f541cc45dd44011c2c4364edc1d1/1?pq-origsite=gscholar&cbl=2037357>)

Kar, S. S., Arora, K., Mani, C., & Jain, P. K. (2016). Characterization of Bituminous Mixes Containing Harder Grade Bitumen. *Transportation Research Procedia*, 17, 349-358. (<https://www.sciencedirect.com/science/article/pii/S2352146516307384>)

**Kar, S.S.,** Tiwari, D., Swamy, A.K., and Jain, P.K. (2016). "Significance of RAP Content and Foamed Binder Content on Mechanistic Characteristics of Recycled Foamed Bituminous Mixes." *Journal of Civil and Environmental Engineering*, 6(2), 220. (<http://dx.doi.org/10.4172/2165-784X.1000220>)

**Kar, S.,** Behl, A., Jain, P.K. and Shukla, A., (2015). Estimation of Carbon Footprints in Bituminous Road Construction: A Case Study. *Indian Highways*, 43(12). 27-32 (<https://trid.trb.org/view/1394586>)

**Swaroop, S.,** Sravani, A., & Jain, P. K. (2015). Comparison of mechanistic characteristics of cold, mild warm and half warm mixes for bituminous road construction. *Indian Journal of Engineering and Material Science*. 22, 85-92 (<http://nopr.niscair.res.in/handle/123456789/31250>)

Swaroop, S., Ghosh, M. K., Sanjay, K., & Mishra, B. K. (2013). Extraction of Cu and Cr from a spent Cu-Cr catalyst: Recovery enhancement through mechanical activation. *Hydrometallurgy*, 136, 8-14. (<https://www.sciencedirect.com/science/article/abs/pii/S0304386X13000534>)

Baba, A. A., **Swaroop, S.,** Ghosh, M. K., & Adekola, F. A. (2013). Mineralogical characterization and leaching behavior of Nigerian ilmenite ore. *Transactions of Nonferrous Metals Society of China*, 23(9), 2743-2750. (<https://www.sciencedirect.com/science/article/abs/pii/S1003632613627922>)

## Articles

**Kar, S. S.,& Nagabhushana, M. N.,** (2018) Cold Mix Technology For Rural Roads, *Civil Engineering and Construction Review*, India 31(4), 1-4

**Kar, S. S.,& Jain, P. K.** (2016), An Innovative Method for Repair of Potholes, *Civil Engineering and Construction Review*, India 29(5), 31-36

Jain, P. K. & **Kar, S. S.,** (2015), Patch Fill: An Innovative Method for Repair of Potholes, *Indian Road Congress Bulletin*, 25(1), 45-48

## Hindi Articles

केवल कृष्ण गोला, **शिक्षा स्वरूपा कर**, मनोज शुक्ला एवं एम.एन. नागभूषण, (2018), कटबैक एस्पाल्ट आधारित गड्ढे की मरम्मत विधि का मूल्यांकन, *भारतीय वैज्ञानिक एवं औद्योगिक अनुसंधान पत्रिका*, भारत, 26(1), 37-42 (<http://nopr.niscair.res.in/handle/123456789/45713>)

**शिक्षा स्वरूपा कर** एवं केवल कृष्ण गोला, (2018) डामर के स्रोत और उपयोग, *सड़क दर्पण*, भारत, 17, 43-38 (<https://crridom.gov.in/sites/default/files/Sadak%20Darpan.pdf>)

**शिक्षा स्वरूपा कर** एवं पीके जैन, (2015) पैच फिल : गड्ढे की मरम्मत के लिए एक उत्तम पद्धति,, *सड़क दर्पण*, भारत, 12, 1-5 (<https://crridom.gov.in/sites/default/files/Sadak-darpan-12-09-2015p.pdf>)

## **Annexure II**

Design and development of Pothole Repair Machine, **Siksha Swaroopa Kar**, Dr P K Jain, Dinesh Kumar Sharma, Neha Singh Complete Filed on 21<sup>st</sup> March 2015 Application No: 0821DEL2014, INDIA

Bituminous Compositions Comprising Nano Carbon Black Particles and The Methods of Preparation Thereof, Ashok Sharma, Soni Madhu, Dr P K Jain, **Siksha Swaroopa Kar** and Ms Farhat Filed on 7<sup>th</sup> March 2016, Application No 201611008235, India

Process for laying roads using cold-mix technology, P K Jain, **Siksha Swaroopa Kar**, Rajiv Aggrawal, Filed on 17<sup>th</sup> Novemebr 2016, Application No 201611039241 (File Number) , India

Engineering of Bitumen Emulsion based Pothole Repair System, Siksha Swaroopa Kar, M N NAgabhushana, Satish Chandra, Filed on 3<sup>rd</sup> May 2019, Application No 01911017676, India



## Annexure III

### Doctor of Philosophy

Sl No	Name	Research Area	Institute	Year	Remark
1	Fadamoro Oluwafemi Festus	Performance Evaluation of Foam Bitumen Stabilization Using Warm RAP Material and Aggregates	Academy of Scientific and Industrial Research	2018 Registered	As Co-Supervisor Main Supervisor: Dr Devesh Tiwari, CSIR-CRRI

### Master of Technology

Sl No	Name	Research Area	Institute	Year	Remark
1	Kavya GM	Diffusion Study of Rejuvenator in Recycling of Pavement	JNNCE, Shimago, Karnataka	2019-20	Co Supervisor: Sh M N Nagabhushana
2	B Pawan Kumar	Feasibility study of Chrome Slag in SMA Mixes	JNNCE, Shimago, Karnataka	2019-20	Co Supervisor: Dr Ambika Behl
3	Darshan Jariwala	Effect of Mixing Technique in Cold Mix Technology	FTE, The MSU Baroda, Gujarat	2019-20	-
4	Hazratullah Paktin	Performance Evaluation of foam bitumen	IIT Delhi	2017-18	As Co Supervisor
5	Aashta Mehta	The influence of quality and quantity of RAP on foam bitumen mixes	M S University of Baroda, Gujarat	2016-17	-
6	Kuswash Singh Bhagat,	Comparative Study On Bituminous Concrete Mixes Using Waste Materials (Steel Slag and Modified Crumb Rubber Binder	NIIT, Bhopal	2014-15	-
7	Ritika Mishra	Rheology of Bitumen Modified with Leather Waste	SVNIT, Surat	2014-15	Summer Internship
8	Sidharth Shrama,	Rheology of Foamed Bitumen and Study of Foam Asphalt Mixes	SVIT, Indor	2013-14	-

### **Bachelor of Technology**

<b>Sl No</b>	<b>Name</b>	<b>Research Area</b>	<b>Institute</b>	<b>Year</b>	<b>Remark</b>
1	Devika Harikumar,	Effects of rejuvenators on aging properties of viscosity grade bitumen through FTIR analysis	APJ Abdul Kalam Technological University	<b>2018</b>	-
2	Riya Mittal	Modification of Bitumen using Medical Waste	Chandigarh Group of College of Technical Campus	<b>2017</b>	-
3	Kartika Tanwar	Comparison of the properties of Cationic SS2, Polymer Modified Two-in-one and All-in-one emulsion with lime and cement as filler	IIT, Delhi	<b>2015</b>	-

**Annexure IV****CSIR-CRRI In house R&D Projects**

SI No	Project Title	Duration
<i>As Principal Investigator</i>		
1	Development of Low Energy Asphalt Mixes Using Foam Bitumen and Cationic Bitumen Emulsions	2013-2015
2	Design and Development of Pothole Repair Machine for Rural Roads	2014-2017
3	Development of specifications of noise absorbing friction courses in rainwater harvesting for Indian Conditions.	2015-2017
4	Development and Testing of Prototype Pothole Repair Machine	2018-2020
5	Effect of rheological Characteristics of Bitumen on Foam and Resulting Mixes	2015-2020
<i>As Team Member</i>		
1	Determination of adulteration of binder during transportation.	2015-2016
2	Proposal for modernization and infrastructure up gradation of R&D facilities in Flexible pavement division	2015-2020
3	Utilization of PVC based waste generated from medical blisters (Pharmaceutical Waste ) in asphalt Road Construction	2018-2020
4	Modernization and Infrastructure Up-gradation of R&D facilities for Pavement and Environmental Engineering	2017-2020

**Government Aided Projects**

SI No	Project Title	Duration	Sponsoring Govt.
<i>As Principal Investigator</i>			
1	Application of Cold Bituminous Based Eco-friendly Road Building Technology for the Special Featured Himalayan Regions	2019-2022	MoEF under NMHS Scheme
2	Cold Mix technology for high volume roads	2019-2020	CSIR Funded under FBR Category
3	Development of Rejuvenating Agent for use in	2019-2020	CSIR Funded under FBR

	recycling of asphalt pavement		Category
<b>As Team Member</b>			
1	Zero Emission Research Initiatives for Solid Waste from Leather Industry (Includes two tasks)	2013-2017	CSIR 12 <sup>th</sup> Plan Project
2	Development and Application of Technologies for Sustainable Transportation (SUSTRANS) <ul style="list-style-type: none"> <li>• WP 10- Conversion of Chromium containing solid waste generated in leather industry into pavement Sector</li> <li>• WP 12- Development of Technology Superior PERforming bituminous PAVements (SUPERPAVE)</li> <li>• WP 14- Use of Reclaimed Asphalt Pavement in Construction and Maintenance of Roads</li> <li>• WP 15- Estimation of Carbon Footprints in Road Construction Process</li> </ul>	2013-2017	CSIR 12 <sup>th</sup> Plan Project,

#### Sponsored R&D Projects

Sl No	Project Title	Duration	Sponsoring Agency
<b>As Principal Investigator</b>			
1	Up gradation and Modification of Cold Mix Technology	2016-2018	M/s Bitchem Asphalt Technologies
2	Evaluation of Antiskid Hot & Cold treatment.	2015	Metalite Eco Future Labs Pvt Ltd,
3	Evaluation of Crack Sealing Method	2015	Metalite Eco Future Labs Pvt Ltd,
4	Performance Evaluation of OGPC (Open Graded Premix Carpeting) done using Cold Mix Emulsion from Mulyagaon to Palethi motor road in Devprayag Block of Tehri Gharwal, Uttarakanda, for length 7.78 km	2014-2016	Juno Bitumix Pvt. Ltd.
5	Feasibility study on "Utilization of Ferrochrome Slag" in Road Making	2016-2020	Tata Steel Limited

6	Evaluation of "RoadLay PR" for instant pothole mix and special binder for sealing of joints"	2017-2018	Ski Soluation
7	Evaluation of PME Rejuvenator of LN Petrochem Pvt. Ltd	2017-2019	LN Petrochem Pvt. Ltd
<i>As Team Member</i>			
1	Demonstration / implementation of Environmentally Friendly Road Comfort Technology as Pilot Project for Kolkata Municipal Corporation implementation on given stretch ( Phase - I)	2018-2019	Kolkotta Municipal Corporation
2	Development of Carbon Based Additive for Improved Performance of Bituminous Pavement (Phase I)	2015-16	Cleantech International Foundation
3	Feasibility Study on Utilisation of Air-cooled Blast Furnace Slag (ACBFS) in Road Making	2015-17	Steel Authority of India, Ranchi
4	Evaluation of Warm Mix Asphalt	2015-16	AKZO Nobel Indian Pvt. Ltd
5	Development of specifications and guidelines for use of sulphur modified asphalt in bituminous base and binder course construction	2017-2020	Reliance Industries
6	Development of electrochemical mixer-settler and optimization studies for the recovery of palladium from high-level liquid waste	2013	IGCAR, Kalpakkam

### Consultancy Projects

SI No	Project Title	Duration	Sponsoring Agency
<i>As Principal Investigator</i>			
1	Evaluation of Promix Patching Solution	2015	Eco Green Infrastructure & Development Pvt Ltd
2	Investigation for Rehabilitation/Strengthening of Aruna Asaf Ali Road from ORR to M.M. Road approximately 4km Dual Carriageway	2018-19	Public Works Department, (GNCTD)

	Under South Delhi-II		
3	Investigation for Rehabilitation/Strengthening of Aruna Asaf Ali Road from ORR to M.M. Road approximately 4km Dual Carriageway Under South Delhi-II	2017-18	Public Works Department, (GNCTD)
4	Evaluation of "Shali Patch" for Use as Instant Patch Repair/Pothole Filling Material	2019	STP Limited
5	Investigation for Rehabilitation/Strengthening of PWD roads under PWD South East Road-I	2019-2020	Public Works Department, (GNCTD)
6	Investigation for Rehabilitation/Strengthening of PWD roads under division East Road (M 212)/ Sub div I	2019-2020	Public Works Department, (GNCTD)
<b><i>As Team Member</i></b>			
1	Evaluation of Instant Road Repair Mix Esmac PR a ready to use pothole/patch repair mix for bituminous pavement	2017	Esbee Road Products
2	Pavement Design and Mix Design of RAP with Foam Bitumen for Lambia Section for Rajasthan State.	2014-15	G R Infra Pvt Ltd
3	Design of job mix for microsurfacing work for various PWD Roads under Chief Engineer North of Delhi PWD (Five Packages)	2016-17	PWD, North Zone, Delhi
4	Design and construction methodology for cold in situ recycling of 6 laning of Varanasi-Aurangabad section of NH-2 from km 786.00 to km 871.00 (length 85 km) in the state of UP/Bihar on DBFOT toll basis under NHDP phase-V	2016-17	Limited SOMA Enterprises
5	Improvement/ widening to two laning with paved shoulder of Udaipur-sabroom section from km 55.00 to km 128.712 of NH 44 in the state of Tripura under SARDP-NE Phase A-Cementitious subbase and sub grade	2017-18	National Highways & Infrastructure Development Corporation Limited
6	Pavement design using appropriate recycling option for Madhavpur section (46.54kms) of upgradation work of Gadu-Porbandar section	2017-18	Kalthia Infra Project Private

	of NH-8E		
7	Mix design for CTSB and RAP for widening of NH-4 from single lane to 2 lanes in Andaman & Nicobar Islands (Pkg-2, Pkg-3 and Pkg 4) and recommendation on feasible pavement design.	2018-19	Vasishta Constructions Pvt Ltd.
8	Investigation of existing pavement to explore the possibilities and extent of reclamation in rehabilitation in order to maintain level of Road on Madhya Marg, Chandigarh	2018-19	UT Chandigarh
9	Pavement design and mix design using cold in place recycling for repair/rehabilitation work of Bharatpur-Mahua section from km 63+00 to km 120+00 of NH 21 in state of Rajasthan	2018-20	M/s Mahua Bharatpur Expressway Limited
10	Hot in place recycling (HIPR) of Ranchi Ring road section of app length 30 Km-6 lane carriageway. Preparation of HIPR mix design for renewal treatment/preventive maintenance of existing pavement.	2018-19	Infrastructure Leasing & Financial Services
11	Pavement design and mix design using cold in place recycling with foamed bitumen for Beawar Pali project of LnT IDPL in Rajasthan	2019- 2020	Markolines Traffic Controls Pvt. Ltd
12	Investigation for Rehabilitation/Strengthening of Various Roads Sub-Division - SR 11, 12 AND 14 UNDER Division SR-1, PWD New Delhi	2019- 2020	PWD, Delhi