

AN ISLAND-WIDE SDH TRANSMISSION NETWORK FOR THE CEYLON ELECTRICITY BOARD





621.38 04"

Submitted in partial fulfillment for the Degree of Master of Engineering in Electronic & Telecommunication Engineering to the

Department of Electronic & Telecommunication
Engineering
University of Moratuwa
Sri Lanka.

UM Thesis coll.

February 2004.

79893

79893



Declaration

This work, presented in this dissertation, has not been submitted for the fulfillment of any other degree.

UOM Verified Signature

M N S Shiraj Sharifdeen Candidate

UOM Verified Signature

Eng. A T L Kithsiri Samarasinghe wa Sri Lanka. Supervisor



7



Dedication

This work is dedicated to my father,

Late. M N Sharifdeen (Retd. Principal), who's dreams, shall reflect on all my successes.

Acknowledgements

I would like to extend my sincere gratitude to my supervisor Eng. A T L Kithsiri Samarasinghe for the invaluable guidance he extended towards the successful completion of this project. Thanks are also due to the M.Eng. Project co-coordinator Prof. J A K S Jayasinghe, for his valuable comments and corrections.

I would like to thank the former Head of the Dept. of Electronic & Telecommunications, Dr. Dileeka Dias for accepting my project proposal for the masters program, for the advices she rendered and for nominating a suitable supervisor for the project.

And finally the Dept. of Electronic & Telecommunications Engineering of University of Moratuwa and my employer, the Ceylon Electricity Board receive big thanks for providing me the opportunity to pursue my master's degree successfully.



Ind	lex
-----	-----

	Page
1. Introduction	01
2. Literature Survey	05
2.1. Overview of SDH Architecture	05
2.1.1. SDH Hierarchy	05
2.1.2. Introduction to SDH Network Components	07
2.1.3. SDH Ring Protection	09
2.1.4. SDH Network Synchronization	15
2.2. Transmission Characteristics of Optical Fibers	19 10
2.2.1. Attenuation	19 20
2.2.2. Dispersion 2.2.3. Throughput of optical Fibers	20
2.3. Methods of incorporating optical fibres in to power	21
transmission lines	23
2.4. Microwave Link Design	25
•	
3. The SDH Network Design	27
3.1. Identification of Network Nodes	27
3.2. Identification of Rings	29
3.2.1. Central Ring	30
3.2.2. North Central Ring	32
3.2.2. North Central Ring 3.2.3. North Western Ring	33
3.2.4. Spur Links www.lib.mrt.ac.lk	35
3.3. Network Component Schedule	39
3.3.1. Central Ring	39 40
3.3.2. North Central Ring	40 40
3.3.3. North Western Ring 3.3.4. Spur Links	41
3.4. Determination of Transmission Capacities	41
3.4.1. Traffic Assignment	42
3.4.2. Ring Capacities	44
3.5. Puttalam – Anuradhapura Microwave Link Design	46
3.5.1. Path Profile	46
3.5.2. Power Budget	48
3.6. Optical Links	49
3.6.1. A typical OPGW link	49
3.6.2. Power Budget Calculations for a typical OPGW link	53
3.6.3. Dispersion Analysis	55
3.7. Network Synchronization	58
3.7.1. Synchronization Signal distribution	59
4. Protection Against Lightning	61
4.1. Fiber Protection	61
4.2. Equipment Protection	61

5. Cost Analysis 4.1. Cost of OPGW link 4.2. Cost of End Equipment 4.3. Total Project Cost	63 65 66 67
6. Further Discussions	68
6.1. Comparison of different methods of incorporating optical fibres on High Voltage Transmission Lines6.2. Comparison of Project Cost6.3. A Case Study6.4. Marketing Aspects	
7. List of Recommendations	78
8. Drawbacks	80
9. References	81
Appendix – A	
Appendix – B	
Appendix – C	
Appendix – D	
Appendix – E University of Moratuwa, Sri Lanka. Electronic Theses & Dissertations www.lib.mrt.ac.lk	
Appendix – F	